

MODERNISATION AND GROWTH IN U. P. AGRICULTURE

THESIS

Submitted to Kanpur University

FOR THE DEGREE OF
Doctor of Philosophy in Economics

By :

PRAMOD CHANDRA

Under the Supervision of

Dr. G. P. MISRA

Professor

Giri Institute of Development Studies, Lucknow.

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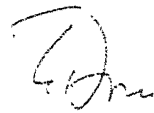
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CERTIFICATE

This is to certify that the enclosed thesis entitled Modernisation and Growth in U.P. Agriculture (A Comparative Study of Eastern and Western Regions), embodies the work of the candidate Shri Pramod Chandra himself and that he worked under my supervision to complete his study for the period required under Ordinance 6. It is further certified that he has put in more than 200 days of attendance at the Giri Institute of Development Studies, a recognised centre for Ph.D. of the University, to work under my supervision.


(G.P. MISHRA)
PROFESSOR

August, 1988

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LUCKNOW

DECLARATION

This thesis entitled 'Modernisation and Growth in U. P. Agriculture' embodies my original work for submission to Kanpur University for Ph. D. Degree. Further I declare that this work either in part or in full has not been submitted elsewhere for any degree or diploma or for publication.

August 1988.


PRAMOD CHANDRA

P R E F A C E

Since inception of planning in rural India planned efforts have been made to modernise agriculture and make it high growth sector. But the modernisation of agriculture is not spatially uniform in its magnitude and impact. As a result there are inter-regional and intra-regional variations in the level of development in Indian agriculture. This is also true in respect of U.P.'s agriculture. A number of programmes and measures have been launched by the State to modernise agriculture in Uttar Pradesh. As a result, the agricultural sector of the state economy has experienced development and growth, but not spatially uniform. Hence it is of paramount importance to analyse the relationship between modernisation and growth in agriculture. But in a state like Uttar Pradesh where agricultural conditions are highly variable, a comparative study assumes relatively greater importance.

I owe to a number of persons and organisations for conducting, organising and completing the present work. I deem it my pious duty to put on record my deep sense of gratitude to Prof. G.P. Mishra under whose foster-care and inspiring guidance I ventured to undertake and complete the present work.

The study required to work on it full time for about five years which was made possible by Indian Council of Social Science Research who provided me doctoral fellowship for four and half year. I appreciate and record my sincere thanks to Dr. T.S. Papola, Ex-Director of the Institute for his encouragement and extending required facilities to me at the Institute. I am grateful to Dr. B.K. Joshi, present Director of the Institute for his encouragement and constant inspiration and to Professor A.K. Singh for allowing me to complete the present study along with my present assignment.

My thanks are due to Mr. Kailash Joshi and C.S. Tiwari for their cartographic help and to Mr. P.K. Srivastava and Miss Nomita Nigam for going through the type scripts. I also thank to Mr. Manoharan, K. for taking pains during typing work.

My acknowledgement would not be complete if I do not record the eternal reparation of my sister-in-law and younger sister for their affections which can scarcely be over-estimated. I wish they could have been alive to share the pleasure of my work.

Lucknow

August 19, 1988


PRAMOD CHANDRA

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Chapter I

INTRODUCTION : SCOPE AND METHOD

The Problem

Agriculture is the main production activity in rural India. This activity contributes about half of national income and engages about two-third of the population. The fortune of many industries also depends on the development of agriculture, as it also supplies raw materials for them and wage funds for meeting the demand requirements of the people in industrial and urban India. In other words input-output nexus of agriculture is such that all the production sector activities depend on it. But the irony of the fact is that agriculture is still a low productivity sector. Thus the existence of a wide gap between agricultural sector (being quite large and predominant) and the high productivity industrial sector (which is quite small in size) imposes a lot of constraints not only on overall development of the economy but also on the development of the rural area.

Development of agriculture is essential for mitigating this gap and also for overcoming the in-built constraints on the development of the economy.

This becomes more urgent and essential in case of an agriculture dominated backward region like Uttar Pradesh. Now the question is how to develop agriculture for making it a high productivity sector. In this context modernisation of agriculture is suggested. Hence proposed study makes an attempt to analyse the relationship between modernisation and growth in U.P. agriculture.

Since inception of planning in rural India, planned efforts have been made to modernise agriculture. In this context three sets of policy programmes launched so far may be worth mentioning : firstly, intensive agricultural development programmes; secondly, the spurt of new technology; and thirdly intensive rural development programmes. The first two programmes construe a package of measures and schemes to introduce land-augmenting technological change in agriculture. The objective of this change is to raise yield and employment potentials of agriculture for accelerating the rate of growth in production and income. The third one includes number of measures to develop rural areas based on cluster approach or growth centre theory or multi-level planning system. Among them the programmes

to diversify agriculture and its allied activities are worth-noting. This is the third stage of modernisation through which Indian agriculture is assumed to be passing. The success of this stage depends on the extent to which the first two programmes have brought about a change in the technical form of production and in the structure of production relations in Indian agriculture.

The Indian experience of modernising agriculture brings the following situations into notice. Firstly, there are areas or regions where the technical form of production has, by and large, changed into a new one and a class of progressive peasants have correspondingly emerged. Secondly, the changes in the technical form of production and production relations have been partial. Thirdly, there has been negligible change in the technical form of production and production relations, more or less, continue to be the same as they were previously. That is why agricultural development varies from one region to another and from one area to another within a given region. The inter-regional and intra-regional variations in agricultural development, as a consequence of their corresponding variations in

the process and form of modernisation, may be on account of various reasons such as lack of productive investment in agriculture-whether public or private, lack of minimum techno-economic infrastructure and the lack of technical dynamism, inventiveness and entrepreneurship.

When we analyse the modernisation and growth of agriculture in the context of Uttar Pradesh, a similar picture emerges as was found in the case of the country as a whole. Thus we find considerable variations between the different regions of the State with respect to the technical form of production and production relations itself. Its five regions namely, Western, Eastern, Central, Bundelkhand and Hill region (though the proposed study, in order to delimit the area of investigation for a single researcher, includes only Western and Eastern regions of Uttar Pradesh) have a lot of variations among themselves and their agriculture and the level of its development also varies from one region to another.

If the extent of irrigated area, intensity of cropping, area under HYV, consumption of fertiliser per hectare and mechanisation are taken together to

show the magnitude of modernisation in agriculture, it may be mentioned that the Western region has significantly undergone the process. The region bearing in the high growth-group indicates that not only the technical form of production has changed but a class of progressive peasants has also emerged in the Western region.

The Eastern region presents more or less the same level of modernisation as the Western region does in respect of area under HYV, and consumption of fertiliser per hectare (with slight difference). But Eastern region, having 2 per cent growth rate and lower level of yields per hectare indicates that the introduction of new technology is not accompanied by corresponding changes in the structure of production relations in agriculture. As a result, the process of modernisation is partial and its effects in agriculture are not the same as they are in the Western region.

The process of growth and modernisation in agriculture is supposed to accompany occupational diversification in a developing agricultural economy. There have been some significant changes in occupational

distribution of work force in Western region wherein modernisation has been successful. In other words, the area where the technical form of production has significantly changed with the emergence of progressive peasants, has experienced some revealing changes in the occupational distribution of work force.

Objectives of the Study

The major focus of the enquiry is three-fold. One of dimensions of the enquiry is to examine the process of modernisation and growth in the context of U.P. agriculture.

The second objective of the study is to single out factors responsible for inter-regional and intra-regional variations in agricultural growth as a consequence of their corresponding variations in the process and form of modernisation.

The third dimension of the study is to examine as to how the process of modernisation involves diversification of agriculture and its allied activities.

Hypothesis

The present study proposes to examine two-fold hypothesis as given below :

a) Modernisation leads to agricultural growth. It removes the agricultural backwardness and so agrarianism which stands as a stumbling block on the way to the process of growth.

b) The process of modernisation and growth in agriculture involves occupational diversification in a developing agricultural economy.

Related Issues

If technology is high in different regions or different areas of a given region, the productivity may not be essentially in the same order. Because for this the process of modernisation must accompany the transformation of agrarian production relations into a new one wherein peasants are more responsive and adaptive to changes in the technical form of production in agriculture.

If the extent of irrigated area, intensity of cropping, area under HYV, consumption of fertiliser per hectare and mechanisation are taken together to show the magnitude of modernisation in agriculture, it may be mentioned that the Western region bearing in the high growth region has significantly undergone the process. The region bearing in high growth group indicates that not only the technical form of production has changed into a new one but a class of progressive peasants have also emerged. Though the Eastern region presents, more or less, the same degree of modernisation, the introduction of new technology is not accompanied by corresponding changes in the structure of production relations in agriculture.

Scope and Method

a) Locale of the Study : The State of Uttar Pradesh has been divided into five economic regions by classifying all the contiguous districts on the basis of similarity in climatic conditions, agricultural conditions, population density and economic activities. These regions are : (i) Bundelkhand region consisting

of 5 districts; (ii) Central region consisting of 8 districts; (iii) Hill region consisting of 8 districts; (iv) Eastern region consisting of 15 districts; and (v) Western region consisting of 18 districts. As stated earlier, the study is limited to Eastern and Western regions (alongwith Gorakhpur and Muzaffar Nagar districts representing Eastern and Western regions respectively) of the State of Uttar Pradesh. It is in the order at this stage to highlight few major and salient features of these regions.

The Eastern region is bounded by Nepal in the North, by Bihar in the East, by Madhya Pradesh in the South and Central region of U.P. State in the West. Eastern U.P. consists of the districts of Gorakhpur, Varanasi and Faizabad divisions (excluding Barabanki) and Allahabad district of Allahabad division. This area is well known for its backwardness, high density of population, low level of per capita income and heavy pressure on land. Industrial development is virtually non-existent except for some sugar mills in North-Eastern region and some industries recently installed in Varanasi, Mirzapur and Allahabad districts.

The Census of India¹ 1961 classified all the districts of India as to their level of development taking into account 35 socio-economic indicators. All districts of Eastern U.P. barring districts of Varanasi, Mirzapur and Allahabad stood on the lowest rank of this classification. Dasgupta² attempted to refine this analysis by taking into account only 24 indicators using the techniques of principal component and discriminant analysis. He, too, arrived at similar conclusions.

The main contributory factors for the backwardness of Eastern region appear to have been high population density, heavy pressure on land because of the absence of industries, low per capita income, neglect of the region in allocation of development funds both by State and Central governments, and lack of irrigation facilities resulting in low agricultural productivity.

¹Census of India, 1961, Part IA(i), Level of Regional Development in India.

²Dasgupta, Biplab, Socio-Economic Classification of Districts, A Statistical Approach; Economic and Political Weekly, August 14, 1971.

The density of population in Eastern U.P, according to 1981 Census was 485 per square km. as against the figure of 377 for the entire State. As against this, the density of population in Gorakhpur district stood at 605 per square km.

This resulted in heavy pressure on land, because 89.34 per cent of the population of Eastern U.P. was rural against the figure of 82.06 per cent of the State. The per capita net area sown in Eastern U.P. was 0.14 hectare as against 0.16 hectare for U.P. Similarly per capita income for Eastern U.P. based on 1981 Census was Rs.611 (at current prices) against Rs.794 for the State. All this clearly speaks of the levels of backwardness and poverty prevailing in the Eastern region. Since the districts of the region falls within the Gangetic plains they have very fertile land. The average rainfall is quite adequate (40" per year) and there is sufficient ground water and abundance of labour. But this area has always been excluded from development efforts and resource allocations firstly because of political reasons and secondly due to the prevalent belief that its people are unresponsive and backward. It was one of the neglected areas even before the British rule, and during British period nearly all agricultural development in U.P. +

in the Western region of the State. A major development was the construction of network of canal system which reduced the element of risk in agriculture and enabled the farmers to experiment with new techniques and crops. Eastern U.P.'s farmers with their high density of population resulting in high pressure on land and complete dependence on natural forces for agriculture, were not in position to take risks or experiment in ways, that if they failed, could threaten their very existence. In Eastern U.P. agriculture was a very low paying activity and received a very low priority in both private and public investment allocations. Holdings were small and scattered and prevailing technology made large scale investments in agriculture both risky and uneconomic. This resulted in capital starvation of the region which further depressed returns for agriculture.³

The introduction of high yielding^{and}/fertiliser responsive varieties alongwith high foodgrain prices raised the hopes of making agriculture profitable even

³ Singh Shrinath; Modernisation of Agriculture : A Case Study in Eastern U.P., Heritage Publishers, New Delhi, 1976.

on small farms in Eastern U.P. The droughts of 1965-66 and 1966-67 also brought about radical changes in government policy as well. The rules for provision of credit and supply of electricity for agricultural purposes (particularly irrigation) were liberalised. This resulted in large investments in agriculture by large and medium size farmers in developing their own irrigation sources. Once the process started, other cultivators observed the economic benefits, that accrued to the early innovators, followed the suit.

With the availability of irrigation facilities, the demand for other inputs such as chemical fertilisers, plant protection measures and improved implements increased and as a result productivity rose.

The consolidation of holdings in the sixties brought about a complete change in farmers' thinking and they began to contemplate in terms of irrigation investment. At the same time, foodgrain prices underwent a sharp rise. The State government, owing to drought in 1965-66 and 1966-67, came in with liberal loan policies and provided electric connections, on priority basis, to farmers who installed irrigation facilities on liberal

loan terms. New high yielding varieties of seeds were, simultaneously, introduced which, alongwith fertilisers and assured water supply, raised farm yields in many folds. There was now a change in the cropping pattern and in the use of other inputs on the irrigated farms. The cropping intensity owing to the above mentioned developments, increased considerably.

The Western region of Uttar Pradesh State is bounded by Hill region in the North, by Bundelkhand and a part of Central region in the East and State of Haryana, Rajasthan, Madhya Pradesh and Delhi in the West. The area of this region is 0.82 lakh square kms. which accounts about 28 per cent of the total area of the State. The density of population is 479 per square kilometre as against 377 for the entire State. As compared to this the density of population in Muzaffarnagar district is 545. According to 1981 Census about 69.16 per cent of the total main workers were found to be engaged in agriculture as against State average of 74.55 per cent. About 81.84 per cent of total holdings are small and marginal holdings. As per 1981 Census

the per capita net cropped area (for rural population) in this region was 0.20 hectares as against 0.15 and 0.19 hectares for the Eastern region and the entire State. The Gross value of agricultural production per hectare at current prices during the year 1980-81 was Rs.5753 as against Rs.4274 in the Eastern region and Rs.4619 in the State as a whole. Similarly the per capita value of agricultural production at current prices was also higher in Western region being Rs.1167 in comparison with Rs.648 in the Eastern region and Rs.878 in the State as a whole. It implies that the value of agricultural production per hectare and per capita in the western region were higher than the corresponding figures for the State as a whole. One can say without least reservation, keeping in mind the above facts, that the Western region has been more productive than the rest part of the State.

The productivity of foodgrains per unit of area in this region is also higher than the State as a whole. The main factor which accounts for the higher productivity is ample supply of irrigation water because region is well equipped with a network of canals which is the major source of irrigation. The gross irrigated area is 61.69 per cent to total cropped area in the

Western region as compared with 40.36 per cent in the Eastern region and 46.27 per cent in the State as a whole.

The development of Industrial sector is impressive in whole of the region. The value of industrial production per capita at current prices works out to be Rs.11788 in this region as against Rs.13361 in Eastern region and Rs.11571 in the State of U.P.

The Western region is highly developed as compared to other regions of the State in terms of industry and agriculture. As stated earlier it is because of quite long experience of public interest in the field of agricultural development since the colonial days. A major development was the construction of a network of Canal Systems which reduced the element of risk in agriculture and gave farmers incentives to experiment with new techniques and crops. Even after independence, the Western region was given priority in all development programmes with a belief that the people in other regions and areas of the State are conservative and unresponsive to change. Later on, during 1960's there was some change in government attitude and some concrete

efforts were made to provide infrastructure for the development of agriculture in the Eastern region.⁴ The growth rate of area and production under foodgrains during 1951-52 to 1980-81 has been higher in Eastern region than in Western region. It is because of the fact that the backwardness of Eastern region exhibited better chances of increase of production per hectare than Western region where the level of production per hectare has already attained the saturation level under existing technological conditions of production.

A brief but comparative picture of development in East and West U. P. presents a case of comparison between developing and developed regions in the State. And this comparative scene of developing and developed regions make the theme of the present study interesting for investigation.

✓b) Methodology : The study has been conducted at macro as well as micro level. At macro level, most of the

⁴Ibid, p.12.

data have been collected from secondary sources like official records and other published materials.

Detailed interviews have also been conducted with government officials, public representatives and other informants to supplement the data. At micro level, the village and farm level data available with the Institute have been utilised to demonstrate the existing production relations in agriculture in Muzaffarnagar and Gorakhpur districts of Western and Eastern regions respectively.

Major Concepts Used

15495 Modernisation, occupational diversification and production relations are such three concepts used at length in our study, which need to be defined at this stage.

Modernisation of Agriculture

In keeping view of the various interpretations and conceptions of modernisation and literature available on the subject we can suggest that agricultural modernisation in developing countries is also related to social

modernisation i.e, agrarian reforms. First of all, a new social structure that makes the producers interested in economic growth and which is able to absorb technical innovations must be formed. The technical innovations have to be oriented toward higher yield and by no means towards a sharp diminishing of man power use.

As a concept, modernisation of agriculture implies here two things : (a) technological transformation of agriculture, and (b) evolution of a new class of peasants, called as progressive peasants or farmers. In other words, modernisation of agriculture aims at changing the tradition-bound technical form of production into modern technical form and also aims at making the peasants responsive and adaptive to new changes in the technical form of production in agriculture.

Production Relations

Production relations can be defined in terms of social relations among people evolving irrespective of their will and consciousness in the process of the production, distribution, exchange and consumption of

material wealth. They are the social form of production through which people appropriate the objects of nature. The production relations in their unity with the productive forces, form a historically defined mode of production. The totality of the production relations constitutes the economic structure of the society which provides a base for a legal and political superstructure.

In the social production of their existence, men inevitably enter into definite relations, which are independent of their will, namely relations of production appropriate to a given stage in the development of their material forces of production. The totality of these relations of production constitutes the economic structure of society, the real foundation on which arises a legal and political superstructure and to which correspond definite forms of social consciousness.⁵

Chapter Scheme

The presentation of analysis and findings of the present study are arranged in six chapters as given

⁵Marx, K, A Contribution to the Critique of Political Economy, Progress Publishers (Moscow), 1977.

below. After dealing with formulation of the problem, scope and method of the study in the present chapter, we have discussed the magnitude of modernisation in agriculture in the second chapter. In the third chapter we have examined the trends in compound rates of growth in area, production and yield under certain crops.

Chapter four attempts to analyse the relationship between modernisation growth and occupational diversification. Chapter five have been devoted to highlight the prevailing production relations in U.P. agriculture. Finally, the main findings of the study have been summarised to arrive at broad conclusions and suggestions regarding the problem of regional variations in agricultural development in the State of Uttar Pradesh.

CHAPTER II

Modernisation in U. P. Agriculture

Concept of Modernisation

Modernisation has been a prominent theme of investigation and debate in the last three decades. A wide variety of academic disciplines have joined together to resolve many dilemmas of modernisation. Significant historical, economic and psychological, political and sociological perspectives have emerged on the subject. In fact, this is one of the areas of social science enquiry in which powerful inter-disciplinary thrust has been made. Some of the major achievements of this scholarly endeavour are identification of the broad features of traditional and modern societies, preparation of a set of indicators of modernisation, historical analysis of forces and factors leading to modernisation of different societies, critical and often perceptive comment on the causes of its breakdown and a multi-disciplinary effort to determine its pre-requisites. Some attention has been given to developing management guidelines to ensure rapid and, if possible, painless modernisation, but no conspicuous gains have been registered so far in this sphere.

A look at the literature reveals two broad types of conceptions of modernisation which, far want of better terms, may be levelled bipolar and focal. Popular among the bipolar conceptions are those built on the dichotomy of tradition and modernity, underdevelopment and development; and pre-industrial and industrial societies. Unlike bipolar conceptions, focal referents tends to be unitarian in their concern. The notable focal conception of modernisation are structural, technological and valuational.

Though useful for the limited purposes both conceptions of modernisation suffer from one shortcoming or the other and failed to command universal unanimity. However, taking a most balanced, rational and impartial approach it can be said with least reservation that rationality is the generic value of modernisation. If there is a common feature in the various definitions of modernisation, it is explicit recognition of the centrality of rationality in the process of structural transformation along rational lines. In its elementary sense, rationality implies use of reason as a governing factor of individual action as well as of corporate activity. In scientific sense, rationality signifies a commitment to the rule of evidence. In its applied sense,

rationality refers to the choice of means intrinsically best suited to the attainment of a given empirical end.

The essence of the modernisation thus lies in a rational transformation of the social, economic and political order of a society. The rational transformation of the social order implies a movement in the direction of a rational scrutiny of traditional practices. The rational transformation of the economic order involves technological advancement. Finally, the rational transformation of the political order signifies continual diffusion of political power to wider groups of the society and ultimately to the people in general.

— Evidently a rationalistic conception of modernisation is not unitary but unfold. Unlike current definitions which tend to assume a unidisciplinary perspective with the result that they provide a partial view of modernisation, the present definition points to the significance of an inter-disciplinary perspective since it treats modernisation as an essentially multifaceted process. Defined in rationalistic terms, the concept of modernisation can be rescued from its historical, ethnocentric and narrow ideological confines and can be used as an independent analytical tool with the high level of generality.

In the absence of an unanimously agreed upon set of rationally justified human values, an underdeveloped country is faced with three choices : firstly, to fall back upon the set of values readily available from its past; secondly, to borrow the modernisation ideals from an already modernised nation; and thirdly, to make a national choice in the quest of modernisation values. In so far as a nation charts out its own course of modernisation, guided by the national consideration, it becomes a truly modernising nation, i.e., country has to make a rational choice of its future goals and strategies.

In keeping view of the various interpretations and conceptions of modernisation and literature available on the subject, we can suggest that agricultural modernisation in developing countries is also related to social modernisation, i.e., agrarian reforms. First of all, a new social structure that makes the producers interested in economic growth and which is able to absorb technical innovations must be formed. The technical innovations have to be oriented toward higher yield and by no means toward a sharp diminishing of man-power use. As a concept, modernisation of agriculture implies here two things :

a) technological transformation of agriculture; and, b) evolution of a new class of peasants, called as progressive peasants or farmers. In other words, modernisation of agriculture aims at changing the tradition-bound technical form of production into modern technical form and also aims at making the peasants responsive and adaptive to new changes in the technical form of production in agriculture.

Modernisation in U. P. Agriculture

Geo-politically, the present day Uttar Pradesh first came into existence as North Western Provinces in 1835 through a process of the integration and consolidation of different parts of the region under the foothills of the Himalayas which fell into the hands of the British rulers, then represented by the East India Company. Gradually the districts of Jhansi, Jalaun and Lalitpur of the Bundelkhand region were also acquired through annexation. Finally in 1856, the Province of Oudh was also annexed. The Oudh continued to be separately administered by a Chief Commissioner till 1877. Thereafter, the lieutenant governor of the North-Western Provinces also functioned as the Chief

Commissioner of Oudh, laying the basis for eventual integration of the two Provinces into a single administrative unit in 1902, when the name United Provinces of Agra and Oudh was given to this region. The region was renamed as the state of Uttar Pradesh in January 1950, when under the new constitution, the State became a constituent State of the Republic of India.

In the pre-independence period, the agrarian sector presented a general picture of deterioration or stagnation. The post-independence period shows a spurt and advance over the first and half decade and has thereafter been stagnating around that level of attainment in several key respects.

The pre-independence period, i.e., the period under British rule, constituted a span of more than one hundred years ending in 1947. Pandit Jawaharlal Nehru in his "Autobiography" made the following observation regarding the State of Agrarian Sector under the impact of British policies in that period.

"The old self-sufficient village economy had long since ceased to exist. Auxiliary cottage industries,

ancillary to agriculture, which had relieved somewhat the burden on the land, had died off, partly because of state policy, but largely because they could not compete with the rising machine industry. The burden on the land grew and the growth of Indian industry was too slow to make much difference to this. Ill-equipped and almost unawares, the overburdened village was thrown into the world market and was tossed about hither and thither. It could not compete on even terms. It was backward in its methods of production and its land system, resulting in a progressive fragmentation of holdings, made radical improvement impossible".¹

The Zamindari Abolition Committee, in its report, also observed : "In spite of the growing pressure upon land the net area sown has remained practically steady, while the total production has continuously diminished. Agriculture thus came to have an unbalanced position in national economy. It was overcrowded and undeveloped. Thanks to the British policy of retarding India's industrial development, agriculture stagnated and deteriorated, its yield steadily declined, and a tremendous amount of labour came to be wasted over uneconomic holdings. Extensive areas of culturable waste lay undeveloped".²

¹Jawaharlal Nehru, Autobiography, The Bodley Head, London, p.193.

²Report of the United Provinces Zamindari Abolition Committee, Vol. I, Allahabad, 1948, p.26.

It is evident from the various reports like Royal Commission on Agriculture (1928), Indian Industrial Commission (1916-18), Famine Commission and Observations made by the numerous writers and officials that the low level of technology in India's agriculture was one of the major factors for its underdevelopment. The major inputs other than family labour were a paid of bullocks and a wooden plough. Agriculture was greatly dependent on the vagaries of nature, too much rain caused floods and soil erosion, while too little rain reduced production to an extreme, even in the irrigated areas availability of water fluctuated from year to year with rainfall. The farmers relied on the seeds from the previous harvest, used a certain amount of farm yard manure and gave little attention to important tasks like weeding.

The government did not consider the development of agriculture its prime responsibility or concern. It is indicated by the fact that the first step towards the formation of an agricultural department was taken only in 1875 when Sir John Strachey, the lieutenant governor, obtained sanction to the creation of a temporary appointment of Director of Agriculture and Commerce for five years which ultimately became permanent.³ The rising frequency

³ Royal Commission on Agriculture in India, Report, Bombay, 1928, p.24.

and severity of famines and structures and recommendations of the various famine commissions compelled to move in the direction of doing something.

Irrigation projects and construction of Railways were adopted as the solution to aggravating agrarian crisis. But even these were mainly looked upon from the point of view of the augmentation of revenue. It must be singled out that during British times nearly all agricultural development in U. P. took place in the western part of the State. A major development was the construction of a network of canal systems which reduced the element of risk in agriculture and gave farmers incentives to experiment with new techniques and crops. Eastern U. P. farmers on the other hand with their high density of population resulting in heavy pressure on land and complete dependence on natural forces for agriculture, were not in position to take risks or experiment in ways that if they failed, could threaten their very existence. In Eastern U. P. agriculture was a very low paying business and received a very low priority in both private and public investment allocations. Holdings were small and scattered and prevailing technology made large-scale investments in agriculture both risky and

uneconomic. This led capital starvation which depressed returns for agriculture still further.⁴

We may, thus, conclude that except for the Western region the entire plain area of United Provinces presented a picture of stagnation or decline in the agricultural sector in the pre-independence period and constituted the overall reality for the province as a whole. In fact, the basic cause of the steady and continued deterioration in the agrarian situation was the general approach policies pursued by British rulers towards the problems of development in general and of the agricultural sector in particular. These policies were, essentially, one of the buttressing the feudal agrarian relations in the rural sector with a view to having a social base in the country-side among the class of landowners and retarding development so that the country could be retained by them as a colonial appendage of the British economy. The post-independence period was marked by a sharp break from Britisher's approach and policy towards agriculture. The government now considered land reforms and change in the agrarian relations, the initial step for ushering in a period of development. It also considered promotion and direct participation in the development of the economy in general, and, agrarian sector

⁴Ibid p.12

in particular, its major responsibility. A series of measures, such as the abolition of intermediaries and ensuring of security of land tenure for the cultivator, introduction of Panchayat Raj System, etc. were taken to recast the institutional framework in the agrarian sector. These were followed and accompanied by development programmes under the successive plans commencing with the First Five Year Plan launched in 1950-51.

One of the earliest attempts to increase agricultural production through government action was made through the "Grow More Food" campaign, which initiated in 1943 immediately after Bengal famine, was renewed for four years in 1947.⁵ The main objectives of the first phase of the campaign were : (i) to encourage production of food crops in areas where cash-cropping was prevalent; (ii) to extend the area under cultivation; and, (iii) to increase the productivity of land through improved farming methods. The Foodgrains Policy Committee of 1947, headed by Purusottam Das Thakur Das, reviewed the progress made during 1943-47 and then made a series of recommendations, particularly the development of minor irrigation facilities, production of manure and chemical fertilizers and distribution of

⁵B. M. Bhatia, Famines in India 1860-1965 : A Study of Some Aspects of the Economic History of India, Delhi, 1967.

improved seeds.. The Committee also recommended a detailed survey of ground water resources for undertaking tubewell construction, and the setting up of an organization based on village panchayats and cooperatives for reclamation and development of land. The Committee stressed the need for the allocation of grants for non-remunerative schemes and loans for minor irrigation and land improvement programmes. The Committee's main recommendation was to support the idea of community development projects assisted by the United States Government. An enquiry Committee criticised the campaign on the ground that it "touched only a fringe of the population, viz., the larger holders who were induced by subsidies and other forms of assistance to take up improved agricultural methods".⁶

The First Five Year Plan put emphasis on improving the land base used for crop production through major and minor irrigation projects on the one hand and land reclamation and like on the other. A second major emphasis of the plan was on initiating "a process of transformation of the social and economic life of the villages" through newly

⁶ Government of India, Report of the Grow More, Food Enquiry Committee, op. cit.

organized Community Development Programme. The first plan, however, did not particularly emphasise the importance of research for increasing food production although it made substantial provision for strengthening general facilities for agricultural research in the country.

During the First and the early part of the Second Plan agricultural progress was reasonably good. However, the steep fall in crop production in the drought year 1957 focused attention on the fact that the gains achieved were far from adequate. Largely as a consequence of the poor crop yields of 1957-58 which raised concern about the future, Government of India invited a team of agricultural experts, sponsored by Ford Foundation, to work in close cooperation with Indian experts in making a careful study of the agricultural situation and to make recommendations for future action. The team visited India early in 1959 and submitted its report entitled "India's Food Crisis and Steps to Meet It" published in the same year. The report indicated that unless food policy and programmes were re-oriented, there would be a substantial gap between the production and demand. The Government of India accepted in general the recommendations made in the "Food Crisis"

report and invited the Second Ford Foundation Team to assist in planning the Intensive Agricultural District Programme which came to be popularly known as the "Package Programme". The team made their recommendations in a report entitled "Suggestions for Ten-Point Programme to Increase Food Production" published in November 1959. Its recommendations included giving top priority to Food production, price stabilization measures, consolidation and security of land tenure, provision of credit through cooperatives, a nine-fold increase in fertilizer consumption, and an intensive irrigation programme. The most significant recommendation of the team was that efforts should be concentrated on popularising modern inputs and practices in the most productive areas where these were more likely to show results. Subsequently, the suggestions except the one regarding price incentives were approved by the Government of India and the Intensive Agricultural District Programme moved from idea to implementation and action stage in 1960.

The Intensive Agricultural District Programme (IADP) was included in the Third Five Year Plan. The Plan states (p.137): "In pursuance of this proposal, the intensive agricultural district programme has been taken up to begin with in one district in each state. The programme is intended to

contribute both the rapid increase in agricultural production in selected areas and to suggest new innovations, and combinations of practices which may be of value elsewhere". To make the IADP more effective, the Third Plan went on to say that : "An attempt will be made to provide all the essential elements for increasing production to the extent needed An effort will be made to provide credit on a scale sufficient to reach all farmers, including those previously considered uncredit worthy, and credit and marketing will be linked".

The IADP was set up to develop the whole farm community. It was intended that the IADP would work out a programme that both speeded up agricultural production and, at the same time, carried the programme to all farmers, small as well as large, tenants as well as owners of agricultural lands. It would combine all efforts into one programme for general economic development of the area in which it operated.

The establishment of the IADP was thus a new dimension in the direction of modernising Indian agriculture. It was not set up as a completely new or separate project or programme but was built into the existing community development structure and organisation. The IADP was grafted on the existing programmes.

In 1959, seven States were asked to select one district each for the launching of the programme. These were Andhra Pradesh, Bihar, Madhya Pradesh, Madras, Punjab, Uttar Pradesh and Rajasthan. It was agreed that only those districts would be selected for the implementation of the IADP which possessed an assured supply of water, a developed rural institutions like cooperatives and Panchayats, and which were least exposed to natural disasters. By 1967-68 another twelve districts were added to the list.

This novel, expensive experiment, concentrated as it was on a small area, made virtually no dent on India's agricultural economy as a whole.-- The main criticism of the programme was that the national, state and district IADP coordinating committees and policy makers were more concerned with administrative "house keeping" functions, than with fundamental institutional and technical changes, more than three quarters of the allocated money went to expand the rural bureaucracy, and only a quarter was spent on productive activities.⁷

⁷Dorris D. Brown, *Agricultural Development in India's Districts*, Harvard, 1971; D. K. Desai, *An Analysis of IADP Results*, Occasional Paper, Indian Institute of Management, Ahmedabad, 1969.

The agreement with the Ford Foundation lasted ten years, until 1970. Of these, the first seven years were among the worst in terms of food output in the contemporary history of India because of severe droughts. The production figure in 1966-67, at the end of Third Five Year Plan, was a meagre 72 million tons, compared with the 100 million tons planned target, and the 110 million tons recommended by the 1959 Ford Foundation Mission.

New Strategy - Green Revolution

The food situation on the eve of the Green Revolution, i.e., introduction of the new high yielding varieties (HYV) in the mid-sixties, was, to say the least, alarming. From the point of view of the Government there was a need to increase domestic food production at a fast rate, by way of much higher productivity of land, but without upsetting the existing agrarian structure. In 1965 a 'new strategy' for agriculture for the Fourth Five Year Plan was formulated with the following objectives.

- a) To apply scientific techniques and knowledge of agricultural production at all stages, particularly in the fields.

- b) To select a few areas with assured rainfall and irrigation for concentrated application of package of inputs based on improved varieties of seeds responsive to heavy doses of fertilizers, and on other modern inputs.
- c) To achieve higher production of subsidiary foods both through intensive production programmes and overall development.

The new strategy was, at the time of its formulation, independent of the new high yielding varieties of seeds. In fact the draft outline of the Fourth Five Year Plan did not mention the high yielding varieties specifically. The solution to India's food problem was found in a selective policy of choosing the areas which were more responsive to modern inputs for special attention.

During 1963-64, a limited quantity of the new high yielding wheat seeds were imported for experimentation. Extensive trials in 1964-65 and 1965-66 proved their adoptability to Indian conditions. At the same time the International Rice Research Institute supplied high yielding paddy to India. These, alongwith the high yielding hybrid varieties of maize, millet and sorghum, which had been developed in India itself were introduced effectively from

1966-67. Arrangements were now made for : (i) production of certified seeds through national seed corporation, state and farmers and network of registered growers; (ii) supplying seeds treated with insecticides to the cultivators, and, (iii) timely supply of seeds to cultivators.

The major feature of the new strategy is its 'package' approach. New HYV seeds, fertilizers, pesticides, controlled water supply, and mechanical equipment from seed drills to tractors and threshers, all these agricultural inputs together form a package. Another major feature of this new strategy is the emphasis it places on the organisational and institutional arrangements for the production, import and distribution of the entire package of inputs. Under the new strategy local production of fertilizer has been stepped up, arrangements have been made for the multiplication of seeds and extension of irrigation facilities, while a large amount of foreign exchange has been allocated for importing some of the inputs. The credit facilities have been expanded through cooperatives, Government departments, land mortgage banks and commercial banks.

The technology associated with the high yielding varieties, which is popularly known as "Green Revolution",

is not merely a package of inputs, it also incorporates a package of new agricultural practices. The new technology follows a new crop calendar, given the shorter maturing period of the HYV seeds, the possibilities of multiple cropping, and the associated changes in cropping pattern and crop rotation.

Having traced the historical background of agricultural modernisation in U. P., we shall, now, look into the magnitude of the same with the following indicators chosen for the purpose : (i) cropping pattern; (ii) cropping intensity; (iii) irrigation; (iv) area under HYV; (v) fertilizer consumption; and, (vi) agricultural machinery and implements.

Cropping Pattern

Since mid-sixties, the production conditions and the cropping patterns have changed a great deal due to the introduction of the new agricultural technology in U. P. In better irrigated regions such as the Western region the cropping patterns have changed pronouncedly than elsewhere in the State.

Tables 2.1, 2.2, 2.3, 2.4 and 2.5 give a bird eye view of the cropping patterns pursued by state as a whole and districts Muzaffarnagar and Gorakhpur with their respective regions (i.e. Western and Eastern regions) since 1951-52. The tables clearly show that the picture of the mid-seventies is vastly different from the one that obtained during the mid-fifties. The lucrativeness of a crop is a function both of its yield and relative price level. In a situation where the yield levels for different crops have experienced varying degrees of upward shift, even slightly lower relative prices have made the high yielding crops much more lucrative. Thanks to the spectacular improvement in their yield levels, and the incentive of stable prices through the state policy of price support and procurement, wheat and rice have emerged as the most important crops of the state covering over 53 per cent of the gross cropped area in 1980-81 while these accounted only a little over 34 per cent in 1951-52. On the other hand crops such as gram, barley, jowar, bajra and pulses have become less important in terms of area under cultivation.

The area under sugarcane cultivation fluctuated over the period but maintained its share well over 5 per cent of gross cropped area while the growth in area under oil

seeds has been steady. A disquieting feature is that percentage of area under pulses to gross cropped area has sharply declined from 21.27 per cent in 1951-52 to 11.64 per cent in 1980-81. It may, however, be singled out that most of the decline in the share of area under pulses cultivation to total cropped area took place during post-green revolution period.

Cropping pattern in the Western and Eastern regions is more or less the same as observed at the State level. There is a marked difference between two regions with respect to area under maize and sugarcane. Area under these crops as a percentage to gross cropped area increased considerably in Western region while Eastern region could not match the performance.

It is a noticeable factor that the area under gram, barley and pulses in Rabi Crop and jowar, bajra in Kharif season has declined considerably at State-region and district levels. The very reason of such a decline had been that on account of introduction of high yielding varieties of wheat and paddy the majority of farmers had switched on more to the growing of these crops. Virtually since mid-sixties the farmers had shown a tendency of

concentrating on growing specific crops rather than adopting multiple cropping system. This is clearly a progressive attitude towards the new technological development in the last decade and also the commercialisation trend of farming business.

Area under sugarcane at the district level deserves the special attention. Sugarcane is next in importance to wheat in terms of area under cultivation which is about 31 per cent to gross cropped area in Muzaffarnagar while it covers only 2.76 per cent in Gorakhpur.

Intensity of Cropping

As regards cropping intensity which is an indicator of intensiveness of the land use table 2.6 reveals that it was 121.23 per cent in the year 1951-52 and it increased upto 142.69 per cent till 1980-81 in the State as a whole. The Western and Eastern regions along with the districts of Muzaffarnagar and Gorakhpur shows the same trend of increase in cropping intensity during the period 1951-52 to 1980-81, though in terms of percentage Eastern region started with higher cropping intensity (127.60 per cent) as compared to Western region (121.20 per cent) it

could not maintain the lead and lagged behind. The same holds true if we look at cropping intensity of Muzaffarnagar and Gorakhpur where both the districts started on nearly equal terms (128.73 per cent and 126.20 per cent respectively) but Gorakhpur could not match the performance particularly after mid-sixties. The present trend shows that in both the regions (Western and Eastern) alongwith their respective districts of Muzaffarnagar and Gorakhpur had have an edge over the State in terms of cropping intensity. It can be visualised from the table 2.22 that growth in cropping intensity has been positive during entire period 1951-52 to 1980-81 at all levels with the exception of Gorakhpur district wherein it was negative during pre-green revolution. However, it registered higher growth rate (0.99 per cent) than the rate obtained in Muzaffarnagar (0.67 per cent). Noteworthy point is that growth in cropping intensity during post-green revolution period is higher than pre-green revolution period at all levels, i.e., districts, regions and State.

Irrigation

Irrigation is one of the most important and essential inputs for the success of HYV seeds and for increasing the

agricultural production. The development of irrigation is still not very satisfactory in the State as a whole and for most of the period almost for all the crops the farmer has to depend on the rainfall. Though there has been significant increase in the extent of irrigation since 1951-52, it is, far behind than the desired level. The irrigated area at net and gross level was 31.42 per cent and 28.34 per cent respectively in 1951-52 for the State as a whole which increased to 54.89 per cent and 46.27 per cent respectively in 1980-81. It is evident from Tables 2.7 and 2.8 that the extent of irrigation in the Western region and the district of Muzaffarnagar had have been much higher than Eastern region and district Gorakhpur during the period 1951-52 to 1980-81. It is interesting to note that although irrigated area at gross and net level have been higher in Western region, districts Muzaffarnagar and Gorakhpur than the State as a whole throughout the period 1951-52 to 1980-81. Eastern region started with the same note but lagged behind the State after 1968-69. It may, however, be pointed out that most of the increase in the extent of irrigated area has been associated with the post-green revolution period (since 1965-66) when Government introduced various policies to

encourage the minor irrigation development works. It is evident from the table 2.22 that growth in area irrigated by tubewells has been significant and positive throughout the period 1951-52 to 1980-81 at all levels while area irrigated by canals reported a negative growth during the same period in Muzaffarnagar district and Western region though State of Uttar Pradesh also exhibited a negative growth in canal irrigation during post-green revolution period.

A close look at the sourcewise irrigated area given in Tables 2.9 to 2.13 reveals that at the beginning of planning most important source of irrigation was other wells followed by canals in terms of irrigated area in the U. P. as a whole. This trend continued till the 1960 and importance shifted thereafter from traditional sources of irrigation to modern or non-traditional sources like tubewells and pumpsets. This is mainly because of the reason that at the beginning of the planning era, the Government emphasised to install big irrigation projects. Under persuance of such a policy the majority of farmers could not avail needed benefits of irrigation facilities. At a later stage of plan period the priority was changed

from major irrigation works to minor irrigation works. This policy of Government affected the irrigation to a great extent and the farmers also started taking keen interest in increasing irrigation facilities. Since the mid-sixties specially during seventies the Government has spent a huge amount on increasing irrigation facilities.

As a result the canals and other wells which accounted for more than 82 per cent of net area irrigated in 1951-52 declined in importance and accounted for only 41.52 per cent of net area irrigated in 1980-81 while share of the tubewells increased from 5.91 per cent to 53.45 per cent of net irrigated area during the same period in the State. Other sources of irrigation also declined in importance throughout the period 1951-52 to 1980-81. Although Western region along with the district Muzaffarnagar shows the same type of change in sourcewise irrigation as the State, the Eastern region differ in the sense that net irrigated area by canals and tubewells both has increased. It is so because Western region and district Muzaffarnagar started with already higher resource base in terms of canal

irrigation which was 53.66 per cent and 69.05 per cent respectively in 1951-52 while Eastern region and Gorakhpur district began with a poor note having only 5.35 per cent and 1.02 per cent area respectively irrigated by canal in 1951-52 to 1980-81. The growth in net and gross irrigated area (please refer table 2.22) has been found to be significant and higher during post-green revolution period when compared with post-green revolution period at all levels.

HYV Seeds

The introduction of high yielding varieties in the year 1966-67 is one of the important component of modern technology. It is clear from the table 2.14 to 2.18 that the coverage under HYV seeds was very low in the State as a whole upto 1967-68 because the farmers started adopting high yielding varieties after a great hesitation and persuasion.

During 1966-67, the coverage of area under HYV Seeds was merely 1.16 per cent, 1.35 per cent, 1.24 per cent, 2.06 per cent and 1.35 per cent in the State, Western region, Eastern region, districts Muzaffarnagar and Gorakhpur

respectively which increased to 36 per cent, 36.27 per cent, 40.39 per cent, 35.96 per cent and 57.30 per cent respectively in 1980-81. The area under HYV seeds in Eastern region and district Gorakhpur has been higher than the State while in Western region and Muzaffarnagar district it is the same as in the State. A close look at the table reveals that there has been tremendous increase in area under HYV wheat and paddy at all levels (in State, Region and district) while area under HYV Maize, Jowar and Bajra either grew marginally or declined over the period 1967-81. The coverage of area under HYV wheat and paddy in Western region and district Muzaffarnagar is lower than Eastern region and Gorakhpur district respectively. Although growth in area (please refer table 2.22) under high yielding varieties of seeds has been significantly high during 1966-67 to 1980-81 at all levels, Gorakhpur district and Eastern region led the way with a growth rate of well over 21 per cent in area under HYV when compared with 10.776, 18.016 and 20.31 per cent in Muzaffarnagar district, Western region and State respectively.

Fertilizer Consumption

Fertilizer is one of the important inputs for increasing the production specially of new varieties of seeds. Traditionally, the levels of consumption of fertilizer in the U.P. State has been very low. Even in 1967-68, an average farmer applied 8.78 Kg. fertilizer per hectare (6.26 N_2 , 1.71 P_2O_5 and 0.81 K_2O). Total consumption increased rapidly with the introduction of HYVs from 3.86 Kg per hectare (3.35 N_2 , 0.41 P_2O_5 and 0.10 K_2O) in 1970-71 and further to 48.67 Kg per hectare (36.40 N_2 , 8.86 P_2O_5 , 3.41 K_2O) in 1980-81 (Table 2.19).

However, although the total consumption of fertilizer in terms of NPK increased over the period 1956-57 to 1980-81, the use of nitrogenous fertilizer alone has gone up tremendously. Although the trend of increase in fertilizer consumption in both the regions and districts have been the same as at the State level, the extent varies. The level of fertilizer consumption in Western and Eastern regions along with the districts Muzaffarnagar and Gorakhpur has been higher than the State average. The fertilizer consumption in Western region and Muzaffarnagar district is much higher than Eastern region and district Gorakhpur. Growth in fertilizer consumption (please see table 2.22) is found to be significant at all levels during the period 1966-67 to 1980-81.

Agricultural Machinery and Impliments (Tractors, Pumpsets and Threshers)

Table 2.20 depicts the change over time in the number of tractors, pumpsets and threshers. It may be derived from the table that there has been a tremendous increase in the number of tractors, pumpsets and threshers during 1966-72 period in the State as a whole. During this period tractors, pumpsets and threshers recorded an increase of 335.58 per cent, 746.92 per cent and 476.95 per cent respectively. The same trend is found at region and district levels. Though in numerical terms there has been a spectacular rise in the number of agricultural machinery and implements in last 15 years, their use in agriculture is still very low as is evident from table 2.21 which exhibits the number of tractors, pumpsets and threshers per hectare of gross cropped area. Table also highlights the fact that the number of tractors, pumpsets and threshers in Western region and district Muzaffarnagar is higher not only than State average but also than Eastern region and Gorakhpur district average as well. Another noteworthy point is that the number of threshers per hectare in both the regions and districts is higher than the State.

The foregoing analysis suggests that the Western region and district Muzaffarnagar is more developed than Eastern region and district Gorakhpur and well ahead of State level in terms of the development of various indicators of modernisation (except area under high yielding varieties) choosen for the purpose.

Table 2.1 : Cropping Pattern in U. P.

Years	Paddy	Jowar	Bajra	Maize	Wheat	Barley	Gram	Pulses	Oil-seeds	Sugarcane
0	1	2	3	4	5	6	7	8	9	10
1951-52	17.52	4.85	5.61	4.14	16.86	9.47	11.65	21.27	2.15	6.02
1952-53	17.52	4.85	5.61	4.14	16.86	9.47	11.65	21.27	2.15	6.02
1953-54	17.52	4.85	5.61	4.14	16.86	9.47	11.65	21.27	2.15	6.02
1954-55	17.69	4.88	5.61	5.05	19.09	9.35	12.78	21.40	1.99	4.46
1955-56	17.91	4.18	5.27	4.57	19.19	9.37	12.93	21.30	2.07	5.24
1956-57	18.06	4.19	5.27	4.75	18.91	9.35	11.65	20.52	2.14	5.81
1957-58	18.50	4.06	5.15	5.14	17.80	8.43	12.22	21.86	2.12	5.83
1958-59	18.97	4.20	4.96	5.02	17.78	8.54	12.50	21.74	2.35	5.11
1959-60	19.09	4.19	4.95	5.02	17.84	8.49	12.40	21.61	2.14	5.48
1960-61	19.26	4.12	5.01	4.85	18.13	8.50	11.75	20.93	2.11	6.12
1961-62	18.84	3.86	4.38	4.90	18.51	8.24	11.63	20.84	2.58	6.15
1962-63	19.48	4.03	4.66	4.89	18.39	7.63	11.24	20.88	2.62	5.84
1963-64	19.72	4.03	4.60	4.93	17.76	7.18	11.79	21.40	2.77	5.57
1964-65	20.02	3.92	4.79	5.04	17.84	6.75	11.82	20.67	2.97	6.25
1965-66	19.06	3.89	4.47	5.30	18.64	6.71	11.70	20.40	3.05	6.75
1966-67	19.56	4.08	4.58	5.71	19.90	6.84	10.79	19.40	3.25	5.39
1967-68	18.80	3.97	4.68	6.41	21.88	7.10	9.97	18.02	3.26	4.39
1968-69	19.00	3.68	4.71	6.36	22.60	6.47	9.76	17.86	2.81	5.36
1969-70	18.99	3.17	4.44	6.49	23.73	6.44	9.79	17.22	2.88	6.00

Contd/-...

Table 2.1 (Contd....)

0	1	2	3	4	5	6	7	8	9	10
1970-71	19.04	3.16	4.83	6.50	25.45	5.70	8.95	16.05	3.00	5.80
1971-72	20.51	2.70	4.12	6.42	26.26	5.70	8.64	15.31	3.12	5.53
1972-73	19.08	3.18	4.74	6.47	26.76	5.62	8.38	15.30	2.89	5.70
1973-74	19.43	3.06	4.62	6.45	26.12	5.51	8.50	15.11	3.15	6.40
1974-75	19.42	3.15	4.39	6.04	27.00	5.41	7.55	13.82	4.01	6.55
1975-76	20.01	3.42	4.36	6.04	27.28	5.21	7.47	13.66	3.82	6.34
1976-77	20.10	3.04	4.38	5.71	28.61	4.64	7.16	13.17	3.49	6.29
1977-78	20.84	2.88	4.20	5.11	28.95	4.13	7.09	12.80	3.59	7.01
1978-79	21.18	2.71	3.83	4.84	30.41	3.58	6.75	12.77	3.22	6.72
1979-80	21.39	2.88	4.41	4.88	31.86	3.33	6.57	12.44	2.43	5.81
1980-81	21.52	2.76	4.05	4.98	33.01	3.17	6.09	11.64	2.88	5.55

Source : Directorate of Agriculture, U. P., Lucknow.

Note : Figures of the year 1951-52 has been quoted for the years 1952-53 and 1953-54.

Table 2.2 : Cropping Pattern in Western Region.

Years	Paddy	Jowar	Bajra	Maize	Wheat	Barley	Gram	Pulses	Oil seeds	Sugarcane
0	1	2	3	4	5	6	7	8	9	10
1951-52	6.74	4.66	11.48	4.30	21.56	6.65	11.03	20.55	2.13	10.18
1952-53	7.89	4.52	11.67	5.22	22.73	6.68	11.10	20.05	1.84	8.12
1953-54	9.04	4.38	11.86	6.14	23.90	6.70	11.16	19.54	1.55	6.06
1954-55	8.48	4.20	11.80	5.95	23.39	6.40	11.99	19.82	1.70	7.28
1955-56	8.08	3.85	11.12	5.65	24.32	6.22	11.55	19.05	1.84	8.82
1956-57	8.21	3.54	10.99	6.19	24.02	5.99	9.85	18.46	1.94	9.78
1957-58	8.50	3.46	10.47	6.43	21.91	5.18	10.99	21.41	2.30	9.30
1958-59	9.45	3.48	10.26	6.22	21.92	5.32	11.74	21.49	2.16	8.51
1959-60	9.80	3.61	10.44	6.18	21.94	5.14	11.29	20.77	1.96	9.24
1960-61	10.04	3.20	10.51	5.66	22.27	5.22	10.55	19.78	2.19	10.34
1961-62	10.32	3.05	9.23	5.70	22.66	5.21	10.54	20.00	2.80	10.26
1962-63	10.64	3.13	9.93	5.90	22.08	4.61	10.18	19.62	2.87	9.61
1963-64	10.39	3.11	9.79	6.16	21.34	4.26	11.17	20.60	3.10	9.19
1964-65	11.04	2.76	10.07	6.30	20.92	3.83	11.67	19.69	3.26	10.48
1965-66	10.04	2.64	9.17	6.73	22.55	3.81	10.98	18.85	3.72	11.18
1966-67	10.76	2.68	9.15	7.18	24.39	3.85	9.84	18.12	3.97	8.39
1967-68	10.94	2.54	9.33	8.26	27.45	3.91	8.41	15.55	4.01	6.61
1968-69	11.31	2.30	9.37	8.09	27.67	3.33	7.61	15.07	3.14	8.66
1969-70	10.91	2.11	8.67	8.48	28.89	3.18	7.30	13.72	3.13	9.87

Contd.../-

Table 2.2 (Contd....)

0	1	2	3	4	5	6	7	8	9	10
1970-71	10.52	1.96	9.47	8.77	31.61	2.59	5.84	11.51	3.30	9.29
1971-72	10.32	1.91	9.47	8.88	32.76	2.63	5.34	10.90	3.24	9.14
1972-73	10.12	1.86	9.46	8.99	33.90	2.67	4.84	10.28	3.17	8.99
1973-74	10.30	1.75	9.04	8.57	32.98	3.45	4.66	9.63	4.11	10.10
1974-75	10.47	1.64	8.62	8.14	32.06	4.23	4.48	8.98	5.04	11.20
1975-76	11.11	1.55	8.67	8.46	30.60	4.05	4.22	8.70	4.66	10.59
1976-77	11.08	1.47	8.68	7.63	33.10	3.21	3.71	7.82	4.23	10.79
1977-78	11.95	1.29	8.34	6.33	32.47	2.90	3.75	7.49	4.35	12.64
1978-79	12.89	1.10	7.56	5.93	33.65	2.60	3.53	8.17	3.56	11.73
1979-80	12.46	1.27	8.90	6.31	34.63	2.59	2.81	7.71	2.67	10.04
1980-81	13.64	1.63	9.23	7.56	37.95	3.00	2.99	8.15	4.17	10.93

Source : Directorate of Agriculture, U.P., Lucknow.

Note : Figures for the years 1952-53, 1971-72 and 1973-74 have been obtained by taking the average of preceding and succeeding years.

Table 2.3 : Cropping Pattern in Eastern Region.

Years	Paddy	Jowar	Bajra	Maize	Wheat	Barley	Gram	Pulses	Oil-seeds	Sugarcane
0	1	2	3	4	5	6	7	8	9	10
1951-52	31.13	1.70	1.68	5.39	10.55	13.13	7.79	18.38	0.84	4.03
1952-53	30.29	1.65	1.67	5.43	10.99	13.83	8.49	18.85	0.92	3.69
1953-54	29.44	1.60	1.66	5.46	11.43	14.52	9.19	19.31	0.99	3.34
1954-55	29.70	1.72	1.79	5.76	11.48	13.37	8.69	18.76	1.01	3.46
1955-56	30.20	1.24	1.73	5.09	12.43	13.67	9.31	19.30	1.06	3.58
1956-57	30.18	1.49	1.80	4.97	12.08	14.01	8.75	18.66	1.16	3.74
1957-58	31.78	1.28	1.96	5.52	11.44	12.85	8.10	18.06	0.76	4.36
1958-59	31.04	1.35	1.81	5.37	11.31	12.63	8.51	18.43	1.36	3.99
1959-60	30.84	1.39	1.80	5.39	11.41	12.63	8.39	18.49	1.28	4.04
1960-61	31.10	1.25	1.87	5.40	11.66	12.47	7.92	18.20	1.22	4.40
1961-62	30.57	1.34	1.80	5.50	11.98	12.39	7.65	17.91	1.36	4.36
1962-63	31.10	1.30	1.81	5.46	12.66	11.80	7.29	18.34	1.31	3.98
1963-64	32.07	1.22	1.69	5.35	12.64	11.36	7.36	18.22	1.30	3.93
1964-65	32.44	1.33	1.84	5.26	12.87	10.73	7.45	17.93	1.48	4.24
1965-66	31.92	1.36	1.93	5.38	13.20	10.70	7.22	17.59	1.38	4.52
1966-67	32.56	1.43	1.95	5.79	13.87	11.12	6.91	16.72	1.18	4.07
1967-68	31.36	1.42	1.89	6.17	14.61	10.96	6.34	16.09	1.33	3.73
1968-69	31.33	1.45	1.88	6.51	15.46	10.85	6.16	15.76	1.23	4.12
1969-70	30.83	1.16	2.03	6.43	17.17	10.58	6.19	15.36	1.38	4.27

Contd/-....

Table 2.3 (Contd....)

0	1	2	3	4	5	6	7	8	9	10
1970-71	31.35	1.25	2.12	6.25	18.17	9.58	6.01	14.96	1.35	4.15
1971-72	31.54	1.25	2.05	6.24	18.44	9.36	5.97	14.74	1.34	4.29
1972-73	31.73	1.25	1.98	6.22	18.70	9.13	5.93	14.51	1.33	4.43
1973-74	31.99	1.25	1.98	6.05	20.70	8.23	5.76	13.80	1.40	4.28
1974-75	32.24	1.25	1.98	5.87	22.69	7.32	5.58	13.09	1.46	4.13
1975-76	32.78	1.19	1.95	5.62	23.85	6.82	5.57	12.68	1.44	4.02
1976-77	32.73	1.17	1.97	5.58	24.37	6.67	5.40	12.54	1.36	3.98
1977-78	33.17	1.12	1.95	5.44	25.76	5.77	5.38	12.04	1.50	3.94
1978-79	33.14	1.05	1.71	5.13	27.61	4.78	5.38	11.68	1.61	3.91
1979-80	34.71	1.10	1.90	4.84	30.31	3.52	5.12	10.77	1.18	3.69
1980-81	34.61	1.01	1.50	3.41	31.68	3.26	5.23	10.51	1.45	3.32

Source : Directorate of Agriculture, U.P., Lucknow.

Note : Figures for the years 1952-53, 1971-72 and 1973-74 have been obtained by taking the average of preceding and succeeding years.

	Paddy	Jowar	Bojra	Maizi	Wheat	Barley	Gram	Pulses	Oil Seeds	Sugar Cane
1	2	3	4	5	6	7	8	9	10	11
51-52	5.57	0.99	3.28	3.53	26.28	1.23	9.90	15.70	0.35	19.87
52-53	5.46	1.01	3.34	3.24	25.36	1.31	11.15	15.92	0.29	18.79
53-54	7.92	1.69	3.53	4.99	28.93	0.83	11.58	15.77	0.26	15.19
54-55	7.01	1.45	3.20	5.37	27.53	0.68	12.25	15.98	0.29	17.65
55-56	5.90	1.06	3.40	5.04	26.62	0.63	11.47	15.50	0.26	19.87
56-57	5.67	0.86	3.29	5.25	27.51	0.53	8.87	13.60	0.24	21.11
57-58	6.83	0.82	3.07	5.24	26.05	0.54	9.85	15.04	0.21	20.41
58-59	7.62	0.87	2.85	5.13	26.27	0.61	9.98	14.67	0.19	20.06
59-60	8.24	0.90	3.05	4.99	26.36	0.53	9.14	14.16	0.14	20.72
60-61	7.69	0.74	2.70	5.15	25.31	0.39	7.76	12.16	0.12	24.22
61-62	7.79	1.02	2.03	4.58	25.31	0.39	8.01	12.39	0.18	24.38
62-63	8.14	0.61	2.17	4.95	25.63	0.33	7.69	11.91	0.14	23.11
63-64	7.27	0.51	2.15	5.18	24.94	0.33	7.89	11.98	0.14	23.65
64-65	7.79	0.36	1.98	4.38	25.15	0.29	8.16	12.01	0.12	24.65
65-66	9.64	0.30	1.85	4.77	24.87	0.27	6.57	10.08	0.08	25.32
66-67	10.82	0.12	1.18	4.78	28.95	0.26	6.55	10.71	0.14	20.27
67-68	11.80	0.07	1.48	5.57	30.72	0.26	4.45	8.12	0.29	19.45
68-69	10.57	0.21	1.02	4.68	29.76	0.16	3.31	6.75	0.12	25.57
69-70	9.05	0.12	1.11	4.98	30.00	0.13	2.97	5.54	0.11	27.52
70-71	8.33	0.10	0.89	5.81	32.30	0.09	2.84	4.80	0.10	26.01
71-72	9.81	0.14	1.18	6.73	32.63	0.10	2.69	4.77	0.13	29.99
72-73	8.10	0.06	0.75	5.47	34.05	0.07	2.33	4.20	0.12	27.02
73-74	7.68	0.05	0.66	5.03	34.24	0.06	2.83	4.76	0.17	29.59
74-75	6.98	0.02	0.41	4.55	31.54	0.16	1.76	3.01	0.32	32.92

Contnd..

Table 2.4 (Contd....)

1	2	3	4	5	6	7	8	9	10	11
75-76	7.74	0.05	0.35	4.95	30.39	0.14	1.66	2.69	0.29	32.79
76-77	7.45	0.05	0.23	4.08	31.04	0.09	1.15	2.03	0.23	33.55
77-78	7.26	0.02	0.21	3.26	29.33	0.08	1.20	2.01	0.31	37.50
78-79	7.64	0.02	0.20	3.49	31.90	0.06	1.13	2.26	0.32	32.51
79-80	9.70	0.02	0.15	3.35	32.17	0.05	0.89	2.08	0.25	30.74
80-81	9.10	0.03	0.10	3.44	32.68	0.06	1.02	2.38	0.43	30.96

Source : Directorate of Agriculture, U.P, Lucknow.

Table 2.5 (Contd.....)

1	2	3	4	5	6	7	8	9	10	11
70-71	38.91	0.01	0.03	1.62	28.18	6.77	2.34	7.76	1.49	3.84
71-72	39.02	0.01	0.02	1.42	29.26	6.51	2.61	7.98	1.62	3.46
72-73	39.68	0.01	0.02	1.44	28.16	6.21	2.30	7.57	1.57	3.83
73-74	38.02	0.01	0.02	1.69	28.46	6.10	2.68	8.08	1.85	4.08
74-75	39.88	0.01	0.11	1.22	32.21	4.94	2.35	6.87	1.84	3.74
75-76	40.57	0.01	0.06	1.20	32.49	4.87	2.30	6.47	1.78	3.70
76-77	40.95	0.01	0.05	1.18	32.82	4.57	2.20	6.44	1.68	3.53
77-78	40.06	0.01	0.06	1.22	34.30	4.32	1.98	5.88	1.76	3.54
78-79	40.02	0.01	0.06	1.08	35.50	3.39	2.19	5.90	1.77	3.53
79-80	40.63	0.02	0.08	0.89	36.12	2.80	2.30	6.01	1.76	3.08
80-81	40.79	0.02	0.08	0.97	38.34	2.10	2.48	5.85	1.78	2.76

Source : Directorate of Agriculture, U.P., Lucknow.

Table 2.6 : Cropping Intensity.

Years	Muzaffar-nagar	Gorakhpur	Western Region	Eastern Region	Uttar Pradesh
1951-52	128.73	125.20	121.20	127.60	121.23
1952-53	129.84	130.39	121.70	129.18	121.23
1953-54	129.69	137.03	122.20	130.75	121.23
1954-55	131.28	130.88	123.91	129.14	123.63
1955-56	131.52	137.31	124.67	130.72	124.61
1956-57	132.82	133.81	127.44	131.65	126.19
1957-58	134.16	128.26	128.04	127.29	125.00
1958-59	135.00	132.93	129.50	131.12	127.71
1959-60	134.86	131.40	127.65	131.51	126.84
1960-61	130.94	133.34	127.05	131.69	126.43
1961-62	132.42	107.86	129.18	132.56	128.09
1962-63	131.35	133.50	126.96	133.04	127.19
1963-64	131.89	132.72	128.63	132.08	127.57
1964-65	132.72	132.19	129.33	132.77	128.20
1965-66	134.55	135.83	128.20	132.42	127.28
1966-67	140.37	128.69	131.13	130.90	127.50
1967-68	143.18	130.03	135.93	132.00	130.01
1968-69	140.08	129.93	134.16	130.09	129.53
1969-70	142.13	135.62	135.52	134.62	132.33
1970-71	146.20	138.00	139.40	134.02	134.11
1971-72	146.65	135.27	139.22	132.78	132.96
1972-73	147.10	132.63	139.05	131.53	133.34
1973-74	145.74	137.46	139.03	132.22	134.01
1974-75	144.36	142.47	139.00	132.90	132.78
1975-76	144.61	142.60	141.46	133.88	134.28
1976-77	146.10	140.46	141.00	133.43	133.25
1977-78	144.93	141.98	139.97	135.05	134.03
1978-79	154.28	145.11	146.93	140.93	139.01
1979-80	154.94	144.11	146.99	139.68	139.09
1980-81	158.27	152.28	150.71	145.20	142.69

Source : Directorate Agriculture, U.P., Lucknow

Note : In Case of State, the figures of the year 1951-52 has been quoted for the years 1952-53 and 1953-54.

Table 2.7 : Extent of Irrigation (Net) in U. P.

Year	Muzaffar-nagar	Gorakh-pur	Western Region	Eastern Region	U. P. State
1951-52	58.71	35.46	37.60	34.90	31.42
1952-53	56.63	37.57	37.21	35.62	31.08
1953-54	56.31	42.70	36.81	36.34	30.73
1954-55	57.38	36.59	36.80	34.14	29.66
1955-56	56.21	41.58	34.25	36.48	29.36
1956-57	55.40	35.58	32.88	31.66	27.31
1957-58	56.25	36.66	33.60	35.20	29.31
1958-59	56.14	37.71	32.57	35.26	28.81
1959-60	57.71	37.41	35.27	35.19	30.07
1960-61	59.10	37.42	34.31	35.51	29.52
1961-62	59.45	36.73	34.00	34.35	28.10
1962-63	60.36	38.19	36.28	36.24	30.59
1963-64	61.15	38.81	37.57	35.89	31.11
1964-65	62.28	40.35	38.71	36.29	31.67
1965-66	66.83	39.44	43.69	36.53	33.87
1966-67	69.91	38.00	47.47	37.07	36.12
1967-68	69.45	39.10	40.80	36.82	32.39
1968-69	75.13	39.72	51.22	37.86	38.01
1969-70	77.03	41.70	53.33	39.07	39.45
1970-71	77.51	49.36	56.24	40.84	41.71
1971-72	77.97	48.69	57.65	40.29	40.36
1972-73	78.44	48.05	59.06	39.74	42.39
1973-74	80.05	50.71	80.88	41.12	42.18
1974-75	81.67	53.46	62.70	42.49	45.41
1975-76	80.74	55.08	63.18	43.05	46.12
1976-77	82.61	54.63	65.95	43.82	47.54
1977-78	83.78	56.38	66.81	44.92	48.75
1978-79	84.62	58.68	68.08	48.35	50.86
1979-80	86.06	57.79	72.26	50.22	52.43
1980-81	85.45	62.78	72.36	52.74	54.89

Source : Directorate Agriculture, U.P., Lucknow.

Table 2.8 : Extent of Irrigation (Gross) in U.P.

Year	Muzaffar-nagar	Gorakh-pur	Western Region	Eastern Region	U. P. State
1951-52	55.12	28.50	35.81	27.87	28.34
1952-53	52.09	29.01	35.02	28.19	28.34
1953-54	51.04	31.39	34.42	28.50	28.34
1954-55	53.73	28.17	34.83	27.25	26.45
1955-56	51.67	30.65	31.36	28.69	25.49
1956-57	51.62	26.95	29.66	24.76	23.58
1957-58	52.48	28.69	30.35	28.45	25.58
1958-59	52.13	28.48	28.94	27.77	24.56
1959-60	52.03	28.58	32.15	27.82	26.19
1960-61	53.78	28.99	31.08	28.08	25.58
1961-62	52.93	34.23	30.16	26.60	23.88
1962-63	55.17	29.08	33.75	28.01	26.58
1963-64	55.98	29.34	34.53	27.88	27.04
1964-65	56.16	30.75	34.56	28.35	27.22
1965-66	62.27	31.14	40.70	28.94	29.93
1966-67	65.27	29.99	44.31	29.63	32.39
1967-68	63.65	30.49	35.90	29.04	27.93
1968-69	71.44	32.00	46.95	30.86	33.75
1969-70	73.93	31.95	48.54	31.57	34.60
1970-71	72.61	36.46	50.20	32.38	36.04
1971-72	73.46	36.42	51.42	32.33	35.14
1972-73	74.30	36.39	52.64	32.07	37.12
1973-74	76.16	37.32	54.25	32.25	36.91
1974-75	78.08	38.21	55.86	34.43	40.33
1975-76	74.40	38.91	53.74	35.11	39.96
1976-77	76.49	39.54	57.42	36.06	42.07
1977-78	77.36	40.05	57.91	36.86	42.87
1978-79	76.90	41.46	57.25	38.33	43.52
1979-80	79.10	41.56	64.85	40.31	46.75
1980-81	81.00	43.13	61.69	40.36	46.27

Source : Directorate Agriculture, U.P., Lucknow.

Note : Figure of the year 1951-52 has been quoted for the years 1952-53 and 1953-54.

Table 2.9 : Area Irrigated by Different Sources as Percentage to Net Irrigated Area in U. P.

Years	Canals	Tubewells	Other wells	Reservoirs	Tanks & lakes	Other sources
1951-52	38.94	5.91	43.59	0.12	X	11.44
1952-53	37.43	5.74	43.15	0.11	4.63	8.96
1953-54	35.91	5.57	42.71	0.09	9.25	6.47
1954-55	36.33	6.31	43.12	0.06	8.34	5.84
1955-56	35.07	6.73	41.77	0.07	10.02	6.34
1956-57	37.30	7.80	39.58	0.05	9.11	6.16
1957-58	38.21	8.71	39.87	0.15	7.71	5.35
1958-59	37.81	9.13	38.28	0.03	8.93	5.80
1959-60	39.15	9.81	37.13	0.04	8.13	5.74
1960-61	39.27	10.71	36.34	0.05	8.26	5.38
1961-62	39.01	11.25	36.42	0.06	8.11	5.16
1962-63	39.76	11.36	35.20	0.04	8.32	5.33
1963-64	40.32	11.90	34.29	0.02	8.20	5.27
1964-65	40.54	13.06	33.82	0.01	7.44	5.12
1965-66	39.01	15.41	34.04	0.01	6.65	4.87
1966-67	38.10	17.83	34.42	0.00	5.47	4.17
1967-68	36.58	20.44	32.98	0.02	5.71	4.27
1968-69	35.76	25.26	29.78	0.01	5.42	3.77
1969-70	35.38	28.70	26.66	0.02	5.26	3.96
1970-71	34.60	32.28	23.60	0.01	5.14	4.37
1971-72	35.74	33.34	21.97	0.01	4.79	4.15
1972-73	33.68	35.77	22.09	0.01	4.44	4.02
1973-74	34.06	36.00	22.12	0.01	4.45	3.37
1974-75	33.67	39.97	17.69	0.01	4.43	4.23
1975-76	34.58	40.20	16.56	0.00	4.27	4.39
1976-77	34.47	43.17	14.85	0.00	3.57	3.94
1977-78	34.88	45.01	13.19	0.02	3.25	3.66
1978-79	35.05	47.32	11.41	X	2.61	3.61
1979-80	31.47	54.17	9.52	X	1.52	3.32
1980-81	33.62	53.45	7.90	X	1.76	3.27

Source : Directorate of Agriculture, U. P., Lucknow.

Note : X included in other sources.

Table 2.10 : Area Irrigated by Different Sources as Percentage to Net Irrigated Area in Western Region.

Years	Canals	Pumpsets or Tubewells	Other wells	Reser- voirs	Tanks & lakes	Other sour- ces
1951-52	53.66	13.24	30.20	0.00	0.00	2.90
1952-53	52.79	12.66	31.70	0.00	0.60	2.18
1953-54	51.92	12.08	33.19	0.00	1.36	1.45
1954-55	51.30	12.74	33.22	0.00	1.30	1.43
1955-56	51.60	14.23	31.59	0.00	1.54	1.05
1956-57	52.44	15.31	29.90	0.00	1.50	0.84
1957-58	52.43	16.09	29.42	0.00	1.18	0.88
1958-59	52.23	16.67	28.51	0.00	1.53	1.06
1959-60	52.18	16.81	28.59	0.01	1.26	1.15
1960-61	51.71	17.61	28.55	0.02	1.39	0.71
1961-62	52.51	17.59	27.98	0.03	1.20	0.69
1962-63	50.88	17.90	28.87	0.00	1.23	1.11
1963-64	50.27	18.51	28.85	X	1.27	1.10
1964-65	49.52	20.12	28.27	X	1.01	1.09
1965-66	44.89	23.07	29.78	0.00	1.10	1.15
1966-67	42.93	25.58	29.40	0.00	0.91	1.18
1967-68	43.32	28.98	26.06	X	0.78	0.87
1968-69	38.56	33.67	25.65	X	0.78	1.34
1969-70	37.31	37.40	23.37	X	0.73	1.20
1970-71	35.03	40.88	22.08	X	0.73	1.28
1971-72	34.32	42.74	20.96	0.00	0.76	1.23
1972-73	33.60	44.59	19.84	X	0.79	1.17
1973-74	32.55	47.82	17.44	0.00	0.83	1.36
1974-75	31.50	51.04	15.03	X	0.87	1.55
1975-76	32.25	50.36	14.63	X	0.67	2.09
1976-77	31.05	52.08	14.19	0.00	0.66	2.02
1977-78	31.08	54.42	12.21	X	0.41	1.87
1978-79	30.98	54.66	11.37	X	0.39	2.60
1979-80	28.23	57.69	10.67	X	0.25	3.16
1980-81	28.78	59.04	9.03	X	0.29	2.87

Source : Directorate of Agriculture, U.P., Lucknow.

Note : (i) X included in other sources
(ii) Figures for the years 1953-54, 1971-72 and 1973-74 have been obtained by taking average of preceding and succeeding years.

Table 2.11 : Area Irrigated by Different Sources as Percentage to Net Irrigated Area in Eastern Region.

Years	Canals	Pumpsets or Tubewells	Other wells	Reser- voirs	Tanks & lakes	Other sour- ces
1951-52	5.35	0.70	72.60	0.10	X	21.26
1952-53	5.33	0.71	68.89	0.11	8.25	16.73
1953-54	5.30	0.71	65.17	0.12	16.50	12.14
1954-55	5.66	1.31	67.20	0.05	14.75	11.03
1955-56	5.81	1.55	63.16	0.05	17.37	12.06
1956-57	6.11	2.82	62.54	0.05	16.04	12.44
1957-58	8.23	4.84	63.30	0.29	13.12	10.21
1958-59	8.66	5.62	59.66	0.02	15.05	11.00
1959-60	9.52	6.63	58.12	0.02	14.39	11.31
1960-61	11.60	8.26	55.44	0.04	14.19	10.47
1961-62	12.05	8.85	54.64	0.04	14.62	9.81
1962-63	12.73	9.27	52.81	0.00	14.97	10.22
1963-64	13.71	9.70	50.89	0.00	15.36	10.34
1964-65	14.57	10.82	50.33	-	14.22	10.06
1965-66	15.22	12.44	49.41	0.00	12.87	10.08
1966-67	13.70	15.08	51.89	-	10.99	8.34
1967-68	14.14	17.30	49.57	0.00	10.86	8.14
1968-69	14.29	23.49	44.37	0.00	11.58	6.27
1969-70	15.47	27.46	39.33	-	10.95	8.58
1970-71	17.06	31.94	32.40	0.00	10.64	7.96
1971-72	16.95	33.63	31.98	0.00	9.86	7.59
1972-73	16.83	35.31	31.55	0.00	9.08	7.22
1973-74	18.60	35.73	28.64	0.00	9.22	7.81
1974-75	20.36	36.15	25.73	0.00	9.36	8.39
1975-76	21.63	38.14	23.23	0.00	9.19	7.81
1976-77	22.82	43.35	19.56	0.00	7.50	6.78
1977-78	24.02	45.11	17.82	-	6.71	6.11
1978-79	24.40	51.31	13.86	-	5.13	5.29
1979-80	24.16	60.96	8.59	-	3.12	3.16
1980-81	26.70	59.09	7.44	-	3.24	3.53

Source : Directorate of Agriculture, U.P., Lucknow.

Note : (i) X included in other sources.
(ii) Figures for the years 1953-54, 1971-72 and 1973-74 have been obtained by taking average of preceding and succeeding years.

Table 2.12 : Area Irrigated by Different Sources as Percentage to Net Irrigated Area in Muzaffarnagar.

Years	Canals	Tube-wells	Other wells	Reservoirs	Tanks & lakes	Other sources
1951-52	69.05	11.79	18.50	0.00	0.00	0.64
1952-53	69.60	11.61	18.20	0.00	0.04	0.53
1953-54	70.15	11.43	17.90	0.00	0.07	0.42
1954-55	69.96	11.39	18.16	0.00	0.08	0.39
1955-56	69.89	11.48	18.16	0.00	0.09	0.36
1956-57	69.76	11.45	18.30	0.00	0.09	0.37
1957-58	69.56	11.76	18.22	0.00	0.09	0.36
1958-59	69.81	11.78	17.93	0.00	0.09	0.37
1959-60	69.90	12.23	17.42	0.00	0.10	0.33
1960-61	68.59	14.54	16.52	0.00	0.10	0.23
1961-62	68.54	15.03	16.08	0.00	0.09	0.23
1962-63	68.00	15.96	15.66	0.00	0.10	0.25
1963-64	67.48	16.63	15.56	0.00	0.08	0.23
1964-65	66.63	19.08	13.99	0.00	0.06	0.22
1965-66	62.64	22.97	13.99	0.00	0.08	0.30
1966-67	59.61	26.79	13.23	0.00	0.09	0.26
1967-68	59.45	28.80	11.51	0.00	0.06	0.16
1968-69	55.42	33.68	10.54	0.00	0.05	0.29
1969-70	52.89	37.53	9.21	0.00	0.03	0.32
1970-71	51.24	40.55	7.86	0.00	0.03	0.32
1971-72	50.42	41.92	7.32	0.00	0.03	0.33
1972-73	49.59	43.28	6.78	0.00	0.03	0.33
1973-74	49.02	45.14	5.57	0.00	0.02	0.27
1974-75	48.45	46.99	4.35	0.00	0.01	0.20
1975-76	47.64	47.87	4.33	0.00	0.01	0.15
1976-77	46.04	49.41	4.31	0.00	0.01	0.23
1977-78	45.19	51.66	2.95	0.00	0.01	0.19
1978-79	44.60	52.70	2.54	0.00	0.01	0.14
1979-80	42.10	55.73	2.01	0.00	0.01	0.17
1980-81	43.26	55.27	1.35	0.00	0.02	0.10

Source : Directorate of Agriculture, U.P., Lucknow.

Note : Figures for the years 1952-53, 1971-72 and 1973-74 have been obtained by taking average of preceding and succeeding years.

Table 2.13 : Area Irrigated by Different Sources as Percentage to Net Irrigated Area in Gorakhpur.

Years	Canals	Tube-wells	Other wells	Reservoirs	Tanks & lakes	Other sources
1951-52	1.02	2.60	52.85	0.00	0.00	43.51
1952-53	3.40	2.25	45.91	0.00	12.93	35.51
1953-54	5.78	1.89	38.96	0.00	25.85	27.50
1954-55	6.37	2.46	41.75	0.00	23.38	26.01
1955-56	0.89	3.55	43.61	0.00	28.70	23.22
1956-57	0.97	4.35	42.13	0.00	29.76	22.77
1957-58	2.06	5.89	44.60	0.00	27.47	19.95
1958-59	1.89	6.18	42.26	0.00	28.67	20.98
1959-60	3.07	7.23	41.76	0.02	29.18	18.72
1960-61	4.05	7.48	40.96	0.00	26.24	21.24
1961-62	6.03	8.06	36.31	0.02	30.74	18.81
1962-63	5.39	8.23	39.45	0.00	27.83	19.07
1963-64	5.71	8.06	38.45	0.00	29.10	18.66
1964-65	5.93	12.15	35.17	0.00	28.37	18.35
1965-66	6.04	13.41	35.16	0.00	24.60	20.87
1966-67	6.37	16.09	41.27	0.00	20.32	15.92
1967-68	5.55	19.76	39.35	0.00	19.98	15.33
1968-69	6.19	25.39	32.89	0.00	18.18	17.23
1969-70	6.69	26.82	30.59	0.00	18.90	16.98
1970-71	11.99	30.55	15.75	0.00	19.01	22.70
1971-72	13.28	39.03	14.39	0.00	14.39	18.93
1972-73	14.56	47.51	13.03	0.00	9.76	15.15
1973-74	17.88	40.00	13.24	0.00	11.18	17.71
1974-75	21.20	32.48	13.45	0.00	12.60	20.27
1975-76	22.89	33.64	12.91	0.00	14.74	15.82
1976-77	25.61	31.99	12.11	0.00	13.76	16.53
1977-78	26.39	45.06	8.12	0.00	8.74	11.70
1978-79	26.68	46.22	8.40	0.00	7.94	10.76
1979-80	24.77	50.08	8.22	0.00	7.68	9.25
1980-81	27.02	48.84	8.77	0.00	6.37	8.99

Source : Directorate of Agriculture, U.P., Lucknow.

Note : Figures for the years 1952-53, 1971-72 and 1973-74 have been obtained by taking average of preceding and succeeding years.

Table 2.14 : Area Under HYV as Percentage to Gross
Cropped Area in U. P.

Year	Paddy	Maize	Jowar	Bajra	Wheat	Total
1966-67	0.90	1.04	0.08	0.07	4.60	1.16
1967-68	3.09	3.65	0.78	-	6.69	4.58
1968-69	7.76	5.94	1.03	0.93	26.78	7.99
1969-70	12.85	5.39	0.91	2.19	30.07	10.05
1970-71	15.32	4.19	0.18	2.63	32.80	11.67
1971-72	21.06	1.08	0.04	3.93	42.35	15.67
1972-73	24.27	1.30	0.07	6.13	54.79	19.67
1973-74	28.58	1.06	0.20	4.21	66.19	23.11
1974-75	32.20	1.47	0.03	4.49	67.48	24.76
1975-76	34.45	1.72	0.03	7.63	73.60	27.01
1976-77	86.09	1.86	0.29	2.47	80.02	30.37
1977-78	44.56	2.67	4.30	4.65	81.17	33.13
1978-79	45.94	3.65	0.33	3.20	78.50	33.79
1979-80	43.23	2.76	0.10	-	68.94	31.35
1980-81	48.14	3.17	0.19	4.69	76.57	36.00

Note : (i) Calculations based on data provided by
Directorate Agriculture, Government of
U.P., Lucknow.

(ii) - Denotes data not available.

Table 2.15 : Area Under HYV as Percentage to Gross
Cropped Area in Western Region.

Year	Paddy	Maize	Jowar	Bajra	Wheat	Total
1966-67	0.83	1.13	0.02	0.09	4.82	1.35
1967-68	3.03	2.28	0.99	3.14	22.21	6.94
1968-69	6.52	4.61	0.97	0.45	32.36	10.13
1969-70	11.42	5.37	0.99	1.95	36.47	12.43
1970-71	15.41	4.57	0.32	2.52	38.33	14.17
1971-72	21.67	1.00	-	4.22	49.07	19.55
1972-73	29.23	1.13	-	6.61	62.63	24.92
1973-74	32.78	1.37	0.96	3.93	77.01	27.87
1974-75	36.13	1.94	0.09	5.12	85.97	30.81
1975-76	38.36	1.90	-	9.16	91.11	33.09
1976-77	44.51	2.00	0.16	2.21	85.31	33.52
1977-78	47.11	3.24	1.63	4.77	83.33	33.31
1978-79	48.51	5.26	1.11	0.02	85.44	35.33
1979-80	43.07	2.59	0.02	-	78.22	32.62
1980-81	52.78	3.39	0.24	5.90	84.99	36.27

Note : (i) Calculations based on data provided by
Directorate of Agriculture, U.P., Lucknow.

(ii) - Denotes data not available.

Table 2.16 : Area Under HYV as Percentage to Gross
Cropped Area in Eastern Region.

Year	Paddy	Maize	Jowar	Bajra	Wheat	Total
1966-67	0.98	1.27	0.03	0.03	6.09	1.24
1967-68	3.37	5.99	0.19	0.84	21.94	4.65
1968-69	8.57	7.77	1.69	2.10	33.19	8.38
1969-70	14.29	4.85	1.62	2.86	35.43	10.88
1970-71	16.69	2.86	0.27	3.71	41.09	12.96
1971-72	22.48	0.75	0.18	5.08	52.75	16.69
1972-73	25.47	1.19	0.23	7.41	64.76	20.42
1973-74	30.93	0.22	Nil	8.03	75.82	23.34
1974-75	34.78	0.47	-	4.62	67.54	26.66
1975-76	37.59	0.91	0.01	5.50	70.85	29.28
1976-77	36.82	1.04	Nil	11.40	86.84	33.36
1977-78	48.87	1.28	0.04	6.25	84.83	38.26
1978-79	48.77	2.01	0.89	0.86	81.68	38.82
1979-80	48.52	2.46	0.57	Nil	63.32	36.16
1980-81	50.81	2.55	0.88	0.83	71.34	40.39

Note : (i) Calculations based on data provided by
Directorate of Agriculture, U.P., Lucknow.

(ii) - Denotes data not available.

Table 2.17 : Area under HYV as percentage to Gross Cropped Area in Muzaffarnagar.

Year	Paddy	Maize	Jowar	Bajra	Wheat	Total
1966-67	0.68	2.25	0.18	0.02	6.50	2.06
1967-68	2.59	2.57	12.99	1.76	23.65	2.74
1968-69	5.95	5.37	1.97	0.24	31.21	10.18
1969-70	11.71	6.20	3.99	2.77	34.50	11.75
1970-71	17.13	7.34	2.78	-	39.47	14.60
1971-72	22.73	2.22	-	7.49	57.11	21.10
1972-73	44.49	2.36	-	37.91	63.26	25.56
1973-74	62.07	2.97	-	29.25	76.14	31.18
1974-75	69.04	3.81	-	12.96	89.39	33.24
1975-76	73.50	3.95	-	14.01	-	36.40
1976-77	90.57	3.59	-	-	87.52	34.06
1977-78	91.37	1.53	-	-	95.93	34.82
1978-79	82.03	2.27	-	-	85.72	33.69
1979-80	68.40	1.61	-	-	82.14	33.11
1980-81	69.07	0.95	-	-	90.69	35.96

Note : (i) Calculations based on data provided by Directorate of Agriculture, Government of U.P., Lucknow.

(ii) - denotes Data not available.

Table 2.18 : Area under HYV as percentage to Gross Cropped Area in Gorakhpur

Year	Paddy	Maize	Jowar	Bajra	Wheat	Total
1966-67	1.42	-	-	-	4.35	1.35
1967-68	4.53	11.85	-	-	27.32	7.21
1968-69	9.12	11.29	-	6.94	32.79	10.83
1969-70	12.76	8.34	6.76	3.75	37.21	13.45
1970-71	16.80	4.86	-	-	42.38	18.56
1971-72	25.63	1.78	-	-	52.73	25.45
1972-73	29.35	1.28	-	-	78.26	31.71
1973-74	38.90	0.38	-	-	82.50	37.52
1974-75	38.88	1.93	-	-	76.09	40.04
1975-76	41.33	3.67	-	-	85.24	44.51
1976-77	45.62	3.57	-	-	96.09	50.27
1977-78	55.48	4.12	-	-	93.33	54.29
1978-79	51.42	10.75	-	-	90.11	52.70
1979-80	57.33	10.74	-	-	53.59	40.47
1980-81	64.62	8.89	46.80	-	88.44	57.30

Note : (i) Calculations based on data provided by Directorate of Agriculture, U.P., Lucknow.

(ii) - denotes Data not available.

Table 2.19: Fertilizer Consumption (Kg/hectare Of Croscropped Area) in U. P.

1	Muzaffar Nagar					Gorakhpur					Western Region				
	N	P	K	Total	N	P	K	Total	N	P	K	Total	N	P	K
	2	3	4	5	6	7	8	9	10	11	12	13	10	11	12
56-57	5.53	0.05	--	5.58	1.09	0.03	--	1.12	1.53	0.03	--	1.56	1.53	0.03	--
57-58	3.10	0.03	--	3.13	1.06	0.05	--	1.11	1.42	0.04	--	1.46	1.42	0.04	--
58-59	2.82	0.27	--	3.09	1.11	0.08	--	1.19	1.88	0.11	--	1.99	1.88	0.11	--
59-60	3.17	0.26	--	3.43	1.07	0.10	--	1.17	1.71	0.11	--	1.82	1.71	0.11	--
60-61	3.13	0.21	--	3.34	1.61	0.27	--	1.88	1.94	0.14	--	2.08	1.94	0.14	--
61-62	3.69	0.27	--	3.96	1.62	0.34	--	1.96	2.03	0.20	--	2.23	2.03	0.20	--
62-63	4.13	0.32	--	4.45	2.64	0.43	--	3.07	2.45	0.23	--	2.68	2.45	0.23	--
63-64	8.31	0.62	--	8.93	4.16	0.66	--	4.82	4.06	0.40	--	4.46	4.06	0.40	--
64-65	9.47	0.83	--	10.30	5.28	0.49	--	5.77	5.34	0.50	--	5.84	5.34	0.50	--
65-66	10.00	0.89	--	10.89	3.66	0.47	--	4.13	5.44	0.51	--	5.95	5.44	0.51	--
66-67	8.49	0.85	0.18	9.52	3.87	0.48	0.03	4.38	4.77	0.56	0.11	5.44	4.77	0.56	0.11
67-68	15.42	4.61	1.87	21.90	9.69	2.20	1.35	13.24	8.26	2.27	1.03	4.56	8.26	2.27	1.03
68-69	24.02	6.87	2.66	33.55	15.67	6.34	3.23	25.24	12.56	4.08	1.88	18.52	12.56	4.08	1.88
69-70	26.28	8.00	3.05	37.33	20.16	6.11	2.44	28.71	16.40	4.98	2.45	23.83	16.40	4.98	2.45
70-71	28.65	6.77	3.57	38.99	18.46	4.70	2.36	25.52	16.46	4.10	2.20	22.76	16.46	4.10	2.20
71-72	33.97	8.82	5.16	47.95	20.08	2.72	1.94	24.74	18.71	4.15	2.65	25.51	18.71	4.15	2.65

Contnd.

Table 2.19 (Contd....)

1	2	3	4	5	6	7	8	9	10	11	12	13
72-73	44.98	7.50	4.46	56.94	23.88	5.18	2.39	31.45	22.02	5.14	2.92	30.08
73-74	40.63	9.29	3.76	53.68	20.79	5.50	2.52	28.81	19.50	5.24	2.49	27.23
74-75	36.26	5.06	2.81	44.13	15.96	2.82	1.44	20.22	18.39	2.81	1.51	22.71
75-76	37.93	5.88	2.32	46.13	21.21	4.83	2.12	28.16	21.44	3.66	1.94	27.04
76-77	54.27	7.98	4.51	66.76	31.49	5.94	3.04	40.47	31.48	5.10	3.21	40.39
77-78	55.17	10.51	4.15	69.83	34.20	7.93	3.70	45.83	35.75	7.82	3.72	47.29
78-79	57.24	10.53	3.35	71.12	39.45	10.41	3.37	53.23	38.92	10.19	3.43	52.54
79-80	53.01	9.66	3.61	66.28	36.45	8.52	3.05	48.02	39.53	9.55	3.30	52.38
80-81	60.49	11.04	3.91	75.44	39.83	4.13	2.80	51.76	46.00	10.61	3.68	60.29

Source: Directorate of Agriculture, U.P. Lucknow.

Note : (i) Per hectare consumption has been obtained by using the Gross cropped area of corresponding year except for the year 1971-72, 1973-74 and 1980-81.

(ii) Per hectare consumption for the year 1971-72, 1973-74 and 1980-81 has been obtained by using the Gross cropped area for the year 1970-71, 1972-73 and 1979-80 respectively.

(iii) Consumption of Potassic fertilizer commenced from the year 1966-67.

Table 2.19 (Contd....)

Fertilizer Consumption (Kg/hectare of
Crosscropped Area)

	Eastern Region				State			
	N	P	K	Total	N	P	K	Total
1956-57	0.79	0.01	--	0.80	0.93	0.02	--	0.95
57-58	0.84	0.03	--	0.87	0.96	0.04	--	1.00
58-59	1.18	0.10	--	1.28	1.25	0.10	--	1.35
59-60	1.03	0.07	--	1.10	1.15	0.07	--	1.22
60-61	1.18	0.10	--	1.28	1.31	0.10	--	1.41
61-62	1.39	0.21	--	1.60	1.46	0.19	--	1.65
62-63	2.21	0.32	--	2.53	1.97	0.24	--	2.21
63-64	3.50	0.47	--	3.97	3.14	0.37	--	3.51
64-65	4.22	0.49	--	4.71	4.00	0.43	--	4.43
65-66	3.81	0.41	--	4.22	3.81	0.40	--	4.21
66-67	3.11	0.39	0.11	3.61	3.35	0.41	0.10	3.86
67-68	6.86	1.73	0.95	9.54	6.26	1.71	0.81	8.78
68-69	11.42	4.34	2.79	18.55	9.81	3.43	1.86	15.10
69-70	15.57	5.70	3.44	24.71	13.32	4.29	2.39	20.00
70-71	13.53	3.68	2.50	19.71	12.56	3.21	1.92	17.69
71-72	15.57	3.27	2.78	21.62	14.70	3.13	2.30	20.13
72-73	16.86	3.85	2.53	23.24	16.25	3.80	2.26	22.31
73-74	14.15	3.69	2.49	20.33	14.33	3.78	2.10	20.21
74-75	14.37	1.96	1.63	17.96	14.45	2.15	1.38	17.98
75-76	18.02	2.79	1.77	22.58	16.71	2.12	1.64	21.07
76-77	27.12	4.78	2.64	34.54	24.72	4.38	2.41	31.51
77-78	30.40	6.47	3.87	40.74	27.73	5.97	3.12	36.82
78-79	34.93	9.25	4.13	48.31	31.78	8.51	3.27	43.56
79-80	34.26	8.24	3.81	46.31	31.99	7.67	3.02	42.68
80-81	38.05	9.38	4.18	51.61	36.40	8.86	3.41	48.67

Source: Directorate of Agriculture, U.P., Lucknow.

Note : (i) Per hectare consumption has been obtained by using the Gross cropped area of corresponding year except to the year 1971-72, 1973-74 and 1980-81.

(ii) Per hectare consumption for the year 1971-72, 1973-74 and 1980-81 has been obtained by using the Cross cropped area for the year 1970-71, 1972-73 and 1979-80 respectively.

(iii) Consumption of potassic fertilizer commenced from the year 1966-67.

Table 2.20 : Number of Tractors, Pumpsets and Threshers
in U. P.

District/ Region/State	1956	1961	1966	1972	1978	Percentage change over the period 1956 to 1978
<u>Muzaffarnagar</u>						
Tractors	335	637 (90.15)	1063 (66.88)	8901 (737.35)	8901 (0.00)	2557.01
Pumpsets	393	1221 (210.69)	3368 (175.84)	14241 (322.83)	25918 (82.90)	6494.91
Threshers	-	-	334	5310 (1489.82)	10232 (92.69)	2963.47
<u>Gorakhpur</u>						
Tractors	196	240 (22.45)	403 (67.92)	896 (122.33)	1628 (81.70)	730.61
Pumpsets	179	243 (35.75)	1404 (477.78)	10102 (619.52)	17037 (68.65)	9417.88
Threshers	-	-	145 (2375.17)	3589 (2375.17)	9190 (156.06)	6237.93
<u>Western Region</u>						
Tractors	2829	3644 (28.81)	5059 (38.83)	25951 (412.00)	37636 (45.03)	1230.36
Pumpsets	4282	7627 (78.12)	22652 (197.00)	131849 (482.06)	256917 (94.86)	5899.93
Threshers	-	-	5216	40078 (668.37)	89881 (124.17)	1623.18
<u>Eastern Region</u>						
Tractors	1180	1525 (29.24)	2254 (47.80)	6071 (169.34)	14082 (131.96)	1093.39
Pumpsets	1686	2832 (67.97)	8800 (210.73)	86865 (887.10)	186464 (114.66)	10959.55
Threshers	-	-	5010	22214 (343.39)	75482 (239.79)	1406.63
<u>State U.P.</u>						
Tractors	5839	-	10053 (72.14)	43789 (335.58)	74100 (69.22)	1169.05
Pumpsets	6319	-	36826 (482.78)	311887 (746.92)	659331 (111.40)	10334.10
Threshers	-	-	14224	82066 (476.95)	210100 (168.20)	1447.38

Source : Livestock Census, U.P., 1956, 1961, 1966, 1972 & 1978.
Note : Figures in brackets indicate the percentage change over
previous year.

Table 2.21 : No. of Tractors, Pumpsets and Threshers
(Per Hectare of Gross Cropped Area) .

<u>District/Region/ State</u>	1956	1961	1966	1972	1978
<u>Muzaffarnagar</u>					
Tractors	0.00078	0.00150	0.00244	0.01860	0.01854
Pumpsets	0.00092	0.00288	0.00773	0.02975	0.05397
Threshers	-	-	0.00077	0.00548	0.01346
<u>Gorakhpur</u>					
Tractors	0.00030	0.00038	0.00621	0.00137	0.00239
Pumpsets	0.00028	0.00038	0.00216	0.01543	0.02496
Threshers	-	-	0.00022	0.00548	0.01152
<u>Western Region</u>					
Tractors	0.00038	0.00048	0.00066	0.00310	0.00440
Pumpsets	0.00057	0.00100	0.00290	0.01580	0.03000
Threshers	-	-	0.00068	0.00483	0.01152
<u>Eastern Region</u>					
Tractors	0.00016	0.00020	0.00030	0.00079	0.00180
Pumpsets	0.00023	0.00037	0.00115	0.01128	0.02389
Threshers	-	-	0.00066	0.00291	0.00967
<u>State U.P.</u>					
Tractors	0.00028	-	0.00046	0.00189	0.00317
Pumpsets	0.00030	-	0.00167	0.01344	0.02824
Threshers	-	-	0.00064	0.00356	0.00943

Note : The data taken from Livestock Census, U.P., 1956, 1961, 1966, 1972 and 1978 have been used to arrive at per hectare figures for various farm implements.

Table 2.22 : Growth in Irrigation, Cropping Intensity, Area Under HYV and Fertiliser Consumption in U.P.

	Gorakh- pur	Muzaffar- nagar	Eastern region	Western region	U.P. State
<u>Net Irrigated Area</u>					
1951-52 to 1965-66	0.22	1.21	0.23	0.52	0.31
1965-66 to 1980-81	3.52	1.26	2.36	3.42	3.21
<u>Gross Irrigated Area</u>					
1951-52 to 1965-66	0.44	1.14	0.11	0.26	-0.03
1966-67 to 1980-81	2.54	1.09	2.31	2.94	3.09
<u>Canals (Irrigated Area)</u>					
1951-52 to 1965-66	8.97	-0.48	9.32	-0.64	0-67
1966-67 to 1980-81	13.57	-2.29	5.08	-2.73	-0.72
<u>Tubewells (Irrigated Area)</u>					
1951-52 to 1965-66	14.30	4.45	26.02	1.14	7.45
1966-67 to 1980-81	6.60	4.93	9.03	5.54	7.33
1951-52 to 1965-66	-0.04	0.33	0.43	0.24	0.41
1966-67 to 1980-81	0.99	0.67	0.80	0.53	0.57
<u>Area Under HYV Seeds</u>					
1966-67 to 1980-81	21.43	10.77	21.10	18.01	20.32
<u>Fertilizer Consumption</u>					
1966-67 to 1980-81	12.04	7.09	13.48	13.88	13.58

Note : Since the use of Chemical Fertilizer was very nominal prior to green-revolution period and HYV seeds were introduced in mid-sixties, growth rate for those two variables have been worked out only for post-green revolution period.

CHAPTER III

Growth in U. P. Agriculture

Since the beginning of planning in 1951 considerable changes have taken place in cropping pattern and crop production in Uttar Pradesh. This Chapter deals with the trends in growth of area, production and yield per hectare under major crops at state, region as well as at district level during the period 1951-52 to 1980-81. The rates of growth have been computed in three phases. In first phase, the growth rates have been computed for the entire period under study, i.e., from 1951-52 to 1980-81. In the second phase, since the year 1965-66 was a turning point in agricultural development when new technology (high yielding fertilizer responsive seeds, etc.) was introduced, the entire period 1951-52 to 1980-81 has been divided in two parts : (a) 1951-52 to 1965-66; and (b) 1966-67 to 1980-81 for computing growth rates. The periods 1951-52 to 1965-66 and 1966-67 to 1980-81 may be termed as pre-green revolution and post-green revolution period respectively. In the third phase, in order to measure the impact of short term fluctuations in growth, the entire period has been divided into six sub-periods and each sub-period covering a time span of five years.

The growth rates for area, production and yield per hectare shall be analysed separately at state, region as well as at district level.

Growth Trends in U. P.'s Agriculture

Table 3.1 highlights the trends in growth rates in area, production and yield per hectare for major eleven crops in Uttar Pradesh during the period 1951-52 to 1980-81.

The trends in growth with respect to area, production and yield per hectare are significant in case of paddy, wheat and oilseeds over the period 1951-52 to 1980-81. All foodgrains and sugarcane claimed for a moderate increase with respect to area, production and yield over the entire period.

Among individual crops wheat followed by maize accounted for the highest rate of growth in area while paddy followed by wheat excelled with respect to production and yield over the reference period.

The rapid growth in area, production and yield under wheat cultivation has been associated mainly with the post-green revolution period 1966-67 to 1980-81 during which growth rate shot up to 4.83 per cent, 8.05 per cent

and 3.07 per cent per annum as compared with pre-green revolution period growth rate of 1.97 per cent and 3.37 per cent and 1.38 per cent per annum for area, production and yield respectively. Though wheat recorded highest growth rate with respect to area, production and yield during the sub-period 1966-67 to 1970-71, it could muster a positive growth rate throughout the post-green revolution period only with respect to area while growth in production and yield slumped to a negative value during the sub-period 1971-72 to 1975-76.

In case of maize, the results are not well convincing. Although it registered significant growth in area and production, the negative trend in yield over the entire period indicates stagnation in cropping pattern. A noteworthy development is that significant growth in area has been mainly associated with the pre-green revolution period while in case of wheat it is just reverse. This reversal in growth trend is simple enough to explain. Though a technological breakthrough has been achieved in case of both crops (i.e., wheat and maize) with the introduction of high yielding fertilizer responsive seeds, a gradual but definite shift has taken place in favour of higher value crop wheat.

Although paddy recorded significant growth in production and yield, it could attain only a moderate increase in area over the entire period. Area under paddy grew during the post-green revolution period, merely by 0.92 per cent per annum which is much below the pre-green revolution period growth rate of 1.89 per cent per year. In case of production and yield, post-green revolution period growth rates are more pronounced.

Besides these cereal crops, oilseeds maintained significant growth in area and production, though with wide fluctuations while yield per hectare attained insignificant growth rate of 0.27 per cent per annum over the period under study. Pre-green revolution period made a spectacular growth in terms of area, production and yield while post-green revolution period conceded negative growth in terms of production and yield along with a nominal increase in area.

The growth rate for all foodgrains has been significant in case of production and yield, it was moderate with respect to area, but it seems to have gone over a full cycle of fluctuations over the six sub-periods under consideration. Starting with a well convincing growth rate in area, production and yield, it slumped in the subsequent sub-period 1956-57 to 1960-61. The sub-period 1961-62 to 1965-66 reported a negative trend in growth with respect

to area production and yield. Sub-period 1966-67 to 1970-71 not only recovered but also registered highest rate of growth in production and yield. Again, sub-period 1971-72 to 1975-76 touched an extreme ebb reporting negative growth rate for all three variables. In the last sub-period 1976-77 to 1980-81 growth rate somehow recovered appreciably.

Sugarcane performed poorly with respect to growth in area but recorded significant increases in case of production and yield over the reference period. Growth in area production and yield under sugarcane cultivation has been subjected to wide fluctuations throughout the entire period. Starting with a clumsy note of negative growth in area and production and marginal growth in yield, it recovered in the next sub-period 1956-57 to 1960-61 in terms of growth in production and yield while growth in area maintained the negative sign. Although growth in area exhibited negative trend during the different sub-periods of pre-green revolution period, it registered significant increase thereafter while growth in production and yield has been subjected to frequent and wide fluctuations throughout the period 1951-52 to 1980-81.

Although there are some indications of improvement in cereals cultivation (specially in case of wheat and paddy) a disquieting development has taken place in case of pulses. The area under pulses shows a declining trend over the entire period. The negative growth in area over the period (more specifically during the post-green revolution period) clearly indicates that a declining trend has set in motion with respect to area. Pulses recorded the highest growth in production and yield during the sub-period 1966-67 to 1970-71 but in subsequent sub-periods 1971-72 to 1975-76 and 1976-77 to 1980-81 reported a negative growth.

Barley is another important crop of the state which conceded a negative growth rate in area and production but maintained moderate growth in yield over the period 1951-52 to 1980-81. The decline in area and production is more dominant during post-green revolution period. It was on account of the fact that farmers preferred growing high yielding fertilizer responsive wheat to barley.

Gram experienced a steady decline in area and nominal increase in production and yield over the period under study. Needless to stress that decline in area is

associated only with the post-green revolution period. In case of production and yield as well pre-green revolution period shows the positive consistency in growth.

The millets, jowar and bajra come next to maize in importance. Both these crops suffered badly over the entire period. It must be pointed out that growth rate during post-green revolution period has been positive in case of bajra while it is negative in case of area only under jowar.

Growth Trends in Eastern and Western Regions

The trends in growth with respect to area, production and yield per hectare in both, the Eastern and Western regions show more or less similar pattern though rate of change differ over the entire period 1951-52 to 1980-81. Following results can be drawn from the study of Tables 3.2

Among the individual crops, superior cereals like wheat and paddy recorded highest rate of growth with respect to area, production and yield per hectare in both regions though Western region did equally well in case of maize also over the entire period.

Growth in area, production and yield under wheat crop is higher in Eastern region while, Western region excelled in case of paddy and maize cultivation over the reference period. It must be pointed out that growth in area production and yield under wheat and paddy have been faster during post-green revolution period in Eastern region while growth rate in case of paddy and maize has been lower, and higher in case of wheat during post-green revolution period in Western region.

Growth in area production and yield under all food-grains shows the same positive trend in both regions though the Eastern region has claimed a very marginal lead with respect to growth in production and yield. Here as well the pre-green revolution period lagged behind post-green revolution period in terms of growth in production and yield. The sub-periods, however, reveal wide fluctuations in growth throughout the period 1951-52 to 1980-81.

Among the inferior cereals, jowar and bajra reported a negative growth in Western U. P. It is evident from the table that bajra has shown some recovery in terms of growth in area, production and yield during the post-green revolution period maintaining a positive growth during

successive sub-periods 1966-67 to 1970-71 and 1971-72 to 1975-76. Although Eastern region shows the similar negative pattern in growth in case of jowar it maintained a positive growth in area and production with respect to bajra over the entire period. Jowar recovered appreciably in terms of growth while bajra cultivation reported significant increase in terms of area and production, it suffered badly with respect to yield during the post-green revolution period.

There is, however, a marked difference between two regions so far maize cultivation is concerned. Although area increased steadily, production and yield could not follow the suit and conceded negative growth in Eastern region over the entire period. The Eastern region, however, conceded negative growth in production and yield in both the pre and post-green revolution periods, the rate of decline is more pronounced in post-green revolution period. The performance of Western region has been impressive in maize cultivation where it enjoyed significant growth rate in area and production along with a marginal growth in yield over the reference period. During the pre-green revolution period, growth rate in area production and yield has been faster in Western region. The fact is well illustrated by negative growth in area production and yield during the sub-periods 1971-72 to 1975-76 and 1976-77 to 1980-81

Among foodgrains, growth rates under pulses cultivation are not well convincing. Pulses cultivation got a set back in both regions. Eastern region experienced a negative growth in area while Western region conceded negative growth with respect to area and production. A noteworthy point in case of pulses cultivation is that pre-green revolution period growth rate is positive and negative growth has taken place during the post-green revolution period in both the regions.

Although both the regions, however, did well with respect to growth in area and production under oilseeds, Eastern region reveals a steep decline in yield per hectare over the period. The post-green revolution period reported negative growth in area, production and yield in Western region while Eastern region attained appreciable growth in area, production and yield during the same period.

Among non-food crops sugarcane reported a spectacular growth in production and yield but performed miserably in terms of area in both regions over the entire period. Growth in area, production and yield has been higher during post-green revolution period than what is obtained during the pre-green revolution period in Western region. The

negative growth in area and production during successive sub-periods 1951-52 to 1955-56, 1956-57 to 1960-61 and 1961-62 to 1965-66 is indicative of the same. The pre-green revolution period growth rate in area and production has been faster than that achieved during post-green revolution period in Eastern region.

Besides these crops, barley and gram cultivation suffered in terms of growth in area, in both regions over the entire period. Eastern region, however, attained a positive growth in production and yield with respect to production and yield in gram.

Growth Trends in Muzaffarnagar and Gorakhpur Districts

In order to ascertain the changes in growth rate in area, production and yield at the district level with respect to eleven crops during the period under consideration, Gorakhpur and Muzaffarnagar districts representing Eastern and Western regions respectively have been selected. Table 3.4 . . . highlight growth trends in area, production and yield in both districts with respect to major eleven crops.

The trend in growth of area, production and yield under major crops is more or less similar in Gorakhpur and

Muzaffarnagar, though there are, however, considerable variations in the rates of change.

To begin with, the pattern of growth in area, production and yield is significant in case of paddy, wheat and sugarcane in both districts, though Gorakhpur district managed somehow an appreciable growth in production and yield along with a positive growth in area with respect to gram also. The rate of growth is highest in area and production though growth in yield also convincing under wheat cultivation in Gorakhpur district. It is pertinent to note that most of the increases were made possible during post-green revolution period which is characterised by a positive growth rate through successive sub-periods 1966-67 to 1970-71, 1971-72 to 1975-76 and 1976-77 to 1980-81 while pre-green revolution period conceded once a negative growth in area, production and yield. Muzaffarnagar district, though maintained a steady growth over the reference period, experienced wide fluctuations in growth in area, production and yield throughout the period.

In case of paddy, though both districts did well, performance with respect to growth in area and production is more impressive in Muzaffarnagar while growth in yield is more convincing in Gorakhpur district. It is evident

from the table that growth in area, production and yield was faster during pre-green revolution period in both districts. A disquieting feature has taken place in Muzaffarnagar district where post-green revolution period conceded a negative growth in area.

Gorakhpur district suffered badly in terms of growth in area production and yield with respect to inferior cereals jowar and maize conceding along with a negative growth in yield under bajra while Muzaffarnagar could muster a positive growth in area and yield with respect to maize only.

In case of barley, both Gorakhpur and Muzaffarnagar districts reveal a similar pattern of growth over the reference period. The barley cultivation recorded negative growth in area and production though managing a positive growth in yield in both the districts over the period under consideration but the magnitude of deceleration is higher in Muzaffarnagar district. Keeping in view the growth figures for different sub-periods, it seems that a negative trend has set in motion with respect to area and production under barley cultivation.

Gram is the only crop where there is a marked difference in growth patterns of area, production and yield in two

districts. Gorakhpur district achieved significant growth in production and yield along with a marginal increase in area while Muzaffarnagar could not follow the suit and registered a negative growth in area, production and yield over the entire period 1951-52 to 1980-81.

The pulses which are the main source of protein in Indian diet suffered in terms of growth over the entire period in both districts. Gorakhpur district reported a negative growth in area while Muzaffarnagar showed negative growth not only in area but also in production.

All foodgrains registered similar positive growth trends in both districts though growth in area, production and yield is more impressive in Gorakhpur than what is observed in Muzaffarnagar district. It may be noted that growth rate in Gorakhpur district is more consistent than district Muzaffarnagar.

Muzaffarnagar district failed miserably in case of oilseeds cultivation where it registered a negative growth in area, production and yield over the entire period. Gorakhpur district, despite an appreciable growth in terms of area and production got a set back in terms of growth in yield. The magnitude of deceleration was faster during

pre-green revolution period whereby Muzaffarnagar conceded negative growth in area, production and yield while Gorakhpur district reported a minus growth in production and yield over the reference period.

Among non-food crops sugarcane attained an appreciable growth in area, production and yield in both the districts though the growth in area and production is faster in Muzaffarnagar district over the entire period. The point of difference between the districts under consideration is that in case of Muzaffarnagar both pre and post-green revolution period reported a positive growth though post-green revolution period witnessed faster growth in area and production while Gorakhpur conceded negative growth in area and production during post-green revolution period.

Briefly speaking, the post-green revolution era presents a picture of higher growth in U.P.'s agriculture than what is observed prior to the green revolution. In this era, intensive agriculture through the introduction of land-augmenting technological change appears to be a major source for the present agricultural growth and shift in cropping pattern, specially shift in area under wheat cultivation.

Table 3.1 : Areas in Growth Rate of Area, Production and Yield per Hectare of Major Crops in Uttar Pradesh, 1951-1952 to 1980-81.

Crops	0	1951-52 1956-57 1961-62 1966-67 1971-72 1976-77 1980-81 1985-86 1990-91 2000-01									
		1	2	3	4	5	6	7	8	9	10
1. Paddy	A	2.03	2.36	1.39	0.07	-2.15	3.64	1.89	0.92	1.42	
	P	15.53	6.59	-4.38	22.29	-0.33	2.69	7.41	9.49	4.79	
	Y	13.24	4.13	-5.69	22.20	1.36	-0.92	5.42	8.49	3.33	
2. Jowar	A	-0.61	-0.01	0.92	-4.94	6.97	-1.76	-0.92	-2.93	-1.17	
	P	-6.38	8.71	22.19	10.57	33.23	-10.60	-3.47	1.92	-2.57	
	Y	-5.81	8.73	21.08	16.32	24.54	-8.99	-2.58	4.99	-1.42	
3. Bajra	A	0.38	-1.55	2.12	2.05	3.66	-1.07	-0.56	0.13	-0.45	
	P	-7.67	6.29	19.79	9.77	0.96	-12.46	-4.24	2.66	-1.85	
	Y	-8.02	7.97	17.30	7.56	6.08	-11.52	-3.70	2.53	-1.41	
4. Maize	A	6.79	2.56	0.97	6.30	-1.24	-4.26	3.31	1.04	2.54	
	P	1.97	-10.88	12.76	8.60	9.35	-8.04	2.02	-0.23	1.96	
	Y	-4.51	-13.10	11.68	2.16	10.72	-3.95	-1.25	-1.26	-0.56	
5. Wheat	A	4.15	-1.82	-0.90	8.08	0.68	4.72	1.97	4.83	2.57	
	P	7.84	0.94	-7.63	18.54	-10.07	8.91	3.37	8.05	4.48	
	Y	3.55	2.81	-6.79	9.69	-10.68	4.01	1.38	3.07	1.87	
6. Barley	A	1.92	-3.40	-6.11	-1.26	-2.01	-9.13	-0.64	-3.45	-1.75	
	P	5.77	4.06	-11.13	1.92	-1.81	-8.13	-0.12	-1.64	-0.74	
	Y	3.77	7.73	-5.35	3.22	0.20	1.10	0.52	1.87	1.03	

Contd.../-

Table 3.1 (Contd....)

0	1	2	3	4	5	6	7	8	9	10
7. Gram	A	4.90	2.32	-0.11	-3.27	-3.32	-1.79	1.50	-3.34	-0.37
	P	10.29	2.61	2.26	23.32	-10.78	-28.70	3.00	1.63	0.10
	Y	5.13	0.28	2.37	27.50	-7.71	-27.40	1.47	5.14	0.47
8. Pulses	A	1.01	2.36	-0.13	-3.27	-2.39	-1.02	0.87	-3.15	-0.52
	P	4.57	0.93	1.22	21.15	-8.10	-7.26	1.95	3.44	0.19
	Y	3.53	-1.40	1.35	25.25	-5.81	-6.30	1.06	6.80	0.72
9. Total Food- grains	A	2.23	0.43	-0.35	1.80	-0.63	1.37	1.04	0.68	0.74
	P	5.34	1.43	-1.90	16.79	-0.84	2.51	2.35	6.26	2.30
	Y	3.04	1.00	-1.56	14.73	-0.21	1.12	1.29	5.54	1.56
10. Total Oil Seeds	A	-2.97	1.10	3.86	-2.03	3.78	-4.60	1.86	0.29	2.31
	P	-0.99	-3.84	8.97	-1.69	19.77	-4.99	3.02	-0.52	2.59
	Y	2.04	-4.89	4.93	0.35	15.40	-0.41	1.14	-0.81	0.27
11. Sugarcane	A	-8.29	-0.93	-0.56	1.04	4.62	1.08	-0.20	1.94	0.39
	P	-7.62	0.88	-0.53	10.22	-14.51	-1.38	1.98	2.82	1.85
	Y	0.74	1.83	0.03	9.08	-18.29	-2.43	2.19	0.87	1.46

Note : A = Area; P = Production; and, Y = Yield.

Crops in Eastern and Western Regionsof U.P. During 1951-52 to 1980-81.

I. Eastern Region

Crops	0	1	2	3	4	5	6	7	8	9	10
		1951-52	1956-57	1961-62	1966-67	1971-72	1976-77	1980-81	1980-81	1980-81	1980-81
		1955-56	1960-61	1965-66	1970-71	1975-76	1980-81	1980-81	1980-81	1980-81	1980-81
1. Paddy	A	-0.15	1.03	1.71	-0.96	-2.54	2.70	0.71	0.40	0.40	0.67
	P	18.00	5.64	-1.73	28.26	-2.49	2.87	7.57	10.71	10.71	4.52
	Y	18.18	4.56	-3.38	29.50	0.05	0.17	6.81	10.26	10.26	3.82
2. Jowar	A	-2.59	-5.21	147.93	-2.52	10.27	-2.34	-4.05	-2.25	-2.25	-1.89
	P	-17.56	26.61	10.02	41.39	47.29	-16.88	-6.88	11.26	11.26	-3.97
	Y	-15.37	33.58	-55.63	45.05	33.58	-14.89	-2.95	13.82	13.82	-2.12
3. Bajra	A	1.71	1.10	0.42	1.23	8.68	-3.34	1.63	-0.16	-0.16	1.11
	P	1.45	12.74	15.29	53.24	43.37	-21.61	2.97	12.85	12.85	0.77
	Y	-0.26	11.51	14.80	51.38	33.76	-18.91	1.32	13.03	13.03	-0.34
4. Maize	A	1.43	3.24	-1.01	4.45	0.65	-2.89	0.76	0.32	0.32	0.76
	P	-19.03	-6.05	-5.55	4.12	103.56	-13.96	-2.26	-4.01	-4.01	-1.01
	Y	-20.17	-9.00	-4.59	-0.31	102.24	-11.40	-3.00	-4.32	-4.32	-1.75
5. Wheat	A	4.78	-2.39	158.31	7.45	-16.57	8.19	0.24	4.11	4.11	2.24
	P	12.79	3.16	-8.63	22.07	2.81	13.62	4.15	11.94	11.94	5.66
	Y	7.65	5.68	-64.63	13.60	23.22	5.12	3.90	7.52	7.52	3.34
6. Barley	A	3.00	-4.30	-4.15	-1.21	133.29	-15.67	0.19	-7.30	-7.30	-2.09
	P	6.88	16.22	-7.74	3.60	-5.60	-13.90	-0.19	-2.77	-2.77	-0.92
	Y	3.76	21.44	-3.74	4.87	-59.54	2.10	-0.39	4.88	4.88	1.19

Contd.../-

0	1	2	3	4	5	6	7	8	9	10
7. Gram	A	6.51	-2.71	-1.00	-3.69	-2.27	0.35	1.33	-2.03	-0.34
	P	19.20	-3.79	-8.30	41.39	-8.21	-4.85	3.57	10.63	1.35
	Y	11.91	-1.11	-7.37	46.80	-6.08	-5.18	2.21	12.92	1.70
8. Pulses	A	2.83	-1.08	0.25	-2.18	-2.28	-3.10	0.84	-2.54	-0.50
	P	9.81	2.66	-6.91	22.06	0.23	-6.28	2.86	3.96	0.67
	Y	6.79	3.77	-7.15	24.78	2.56	-3.28	2.00	6.67	1.17
9. Total Foodgrains	A	1.58	-0.67	0.13	0.72	-0.36	1.40	0.72	0.47	0.51
	P	8.03	3.19	-4.18	18.73	1.66	-11.80	3.12	7.23	2.48
	Y	6.34	3.88	-4.30	17.88	2.03	-13.20	2.38	6.73	1.95
10. Total Oil Seeds	A	7.68	-1.49	0.17	5.47	3.10	3.21	5.29	2.48	3.31
	P	7.04	-11.32	0.24	12.28	10.61	2.35	0.96	4.45	1.12
	Y	-0.60	-9.98	0.07	6.46	7.29	-0.84	-4.10	1.92	-2.12
11. Sugarcane	A	0.10	4.35	-1.80	0.65	0.34	-1.55	0.97	0.19	0.56
	P	-3.31	13.32	-1.99	12.25	4.43	-6.59	3.09	2.75	2.53
	Y	-3.41	8.59	-0.20	11.53	4.08	-5.13	2.10	2.55	1.95

Contd.../-

II. Western Region

0	1	2	3	4	5	6	7	8	9	10
1. Paddy	A	9.43	6.25	0.45	2.11	-2.60	6.07	5.30	1.57	3.67
	P	22.03	15.02	-9.10	12.77	-2.88	4.01	12.26	7.46	8.28
	Y	11.51	8.25	-9.51	10.44	-0.29	-1.94	6.61	5.80	4.44
2. Jowar	A	-2.12	-00.60	-2.19	-5.88	-3.76	-4.21	-3.03	-5.17	-3.50
	P	-16.51	14.32	27.09	-4.55	12.06	-2.27	-8.88	-3.32	-5.93
	Y	-14.71	15.02	29.94	1.41	16.44	2.03	-6.03	1.95	-2.52
3. Bajra	A	1.24	-1.55	1.84	1.79	2.68	-0.51	-0.38	0.36	-0.42
	P	-4.44	3.36	28.02	5.24	3.26	-10.06	-4.54	1.35	-1.85
	Y	-5.61	4.99	25.70	3.39	0.57	-9.60	-4.17	0.99	-1.44
4. Maize	A	17.83	0.08	3.56	8.08	-4.25	-5.81	5.87	2.08	4.10
	P	15.62	-15.56	58.35	19.50	-6.34	-6.76	7.36	2.46	4.57
	Y	-1.88	-15.63	52.90	10.57	-2.18	-1.01	1.40	0.37	0.46
5. Wheat	A	4.02	-2.87	-2.02	8.61	-1.23	2.20	1.39	4.44	2.20
	P	6.01	1.91	-6.44	16.20	-5.12	6.37	2.49	7.70	4.44
	Y	1.92	4.93	-4.51	6.99	-3.93	4.08	1.09	3.12	2.19
6. Barley	A	0.18	-4.85	-9.25	-5.49	11.23	-5.40	-2.29	-2.11	-2.55
	P	5.31	-10.66	-16.04	1.86	7.11	-3.02	-1.37	1.13	-1.07
	Y	5.12	-6.11	-7.48	7.78	-3.71	2.52	0.94	3.31	1.52

Contd.../-

Table 3.2 (Contd....)

0	1	2	3	4	5	6	7	8	9	10
7. Gram	A	2.90	5.62	1.33	-10.26	-3.95	-4.81	0.89	-8.60	-1.96
	P	2.33	6.28	8.99	8.61	-8.08	-12.77	1.47	-3.06	-0.99
	Y	-0.56	0.63	7.56	21.03	-4.30	-8.36	0.57	6.06	0.99
8. Pulses	A	-0.77	5.60	-0.95	-9.75	-5.09	0.64	0.43	-6.89	-1.67
	P	-1.60	1.59	6.09	13.28	-14.35	-10.27	1.03	-1.28	-1.01
	Y	-0.84	-3.80	7.11	24.14	-9.76	-10.84	0.59	6.03	0.67
9. Total Foodgrains	A	2.64	0.67	-5.04	1.93	-1.42	1.10	0.63	0.64	0.68
	P	3.03	1.06	0.12	13.22	-3.95	2.63	1.64	5.30	2.43
	Y	0.38	0.39	5.43	11.06	-2.57	1.52	1.00	4.63	1.74
10. Total Oil Seeds	A	-7.92	4.95	5.42	-4.82	0.54	-5.63	1.74	-0.06	2.96
	P	-6.59	-1.13	11.86	-5.33	15.31	-4.63	3.08	-1.03	3.16
	Y	1.45	-5.79	6.11	-0.53	14.69	1.06	1.31	-0.97	0.19
11. Sugarcane	A	-10.32	-1.35	-1.00	2.13	6.44	2.26	-0.69	3.11	0.28
	P	-9.58	-0.97	-0.24	9.55	8.35	0.50	1.39	6.12	2.31
	Y	0.83	0.38	0.76	7.26	1.80	-1.72	2.09	2.91	2.03

Note : A = Area; P = Production; and, Y = Yield.

Table 3.3 : Trends in Growth Rate of Area, Production and Yield Per Hectare of Major Crops in Gorakhpur & Muzaffarnagar Districts of U.P. (1951-52 to 1980-81).

I. Gorakhpur

	0	1	2	3	4	5	6	7	8	9	10
1. Paddy		A	2.25	-0.31	0.26	1.33	1.38	-5.53	0.83	0.68	0.68
		P	33.30	6.45	5.33	9.93	3.62	-4.24	11.12	4.94	6.45
		Y	30.36	6.78	5.06	8.48	2.21	1.36	10.20	4.22	5.73
2. Jowar		A	24.80	1.81	-13.04	-11.75	15.04	11.42	7.19	-4.28	0.62
		P	2.15	57.86	1.28	57.98	117.03	-5.89	-0.13	14.89	-2.96
		Y	-18.15	55.05	16.46	79.01	88.66	-15.54	-6.83	20.03	-3.56
3. Bajra		A	13.82	1.99	-7.17	-13.69	29.74	12.34	6.55	0.14	2.42
		P	14.77	19.10	-9.13	33.64	75.81	-8.29	6.50	13.39	1.66
		Y	0.84	16.77	-2.12	54.84	35.51	-18.36	-0.04	13.23	-0.75
4. Maize		A	-2.30	3.81	-6.45	14.17	-0.46	-3.64	-0.72	1.35	-0.46
		P	-25.10	-11.03	-8.60	1.99	115.15	-32.62	-6.59	-7.84	-2.96
		Y	-23.34	-14.30	-2.30	-10.67	116.15	-30.08	-5.92	-9.07	-2.52
5. Wheat		A	7.30	-0.46	6.19	10.22	2.24	5.47	3.88	7.74	4.75
		P	11.83	3.83	-3.93	12.15	3.56	14.72	5.10	8.96	7.08
		Y	4.22	4.31	-9.53	1.75	1.29	8.76	1.17	1.12	2.23

Contd../-

Table 3.3 (Contd.....)

0	1	2	3	4	5	6	7	8	9	10
6. Barley	A	6.31	-4.34	-5.85	-5.40	-5.73	-13.60	0.65	-7.56	-2.76
	P	16.48	-1.43	-13.03	-1.56	-0.71	-6.41	3.18	-4.75	-0.45
	Y	9.57	3.04	-7.62	4.06	5.33	8.32	2.51	3.03	2.37
7. Gram	A	17.18	-6.69	3.68	-4.42	-2.52	2.16	4.54	-1.59	0.53
	P	50.12	-2.94	3.79	11.79	-3.09	11.00	11.56	4.97	4.69
	Y	28.11	4.02	0.10	16.95	-0.58	8.66	6.72	6.67	4.13
8. Pulses	A	9.66	-2.07	2.78	-3.80	-3.08	-1.81	2.75	-3.34	-0.47
	P	20.42	4.67	-8.16	14.22	-5.22	3.19	5.36	0.95	0.89
	Y	9.81	6.88	-10.64	18.73	-2.20	5.10	2.54	4.43	1.36
9. Total Foodgrains	A	3.71	-1.17	-0.17	1.98	1.18	1.69	1.14	1.52	0.77
	P	17.78	5.19	-1.64	9.47	3.69	5.78	5.89	5.09	4.30
	Y	13.57	6.43	-1.48	7.35	2.48	4.02	4.69	3.52	3.51
10. Total Oil Seeds	A	14.88	-5.23	0.96	4.62	4.30	3.70	5.13	3.85	3.50
	P	4.85	-1.78	0.26	6.29	17.62	-1.02	-0.22	4.11	1.45
	Y	-8.73	3.64	-0.69	1.59	12.78	-4.55	-5.09	0.25	-1.98
11. Sugarcane	A	-0.17	6.92	-3.21	-3.08	5.07	-2.22	2.19	-1.06	1.26
	P	-1.36	13.99	-3.79	4.40	5.44	-4.51	4.93	-0.17	3.78
	Y	-1.19	6.61	-0.60	7.76	0.35	-2.34	2.69	0.90	2.49

Contd.../-

Table 3.3 (Contd....)

II. Muzaffarnagar

	1	2	3	4	5	6	7	8	9	10
1. Paddy	A	7.51	12.75	1.91	-2.67	-10.18	7.10	4.14	-2.27	3.09
	P	14.82	9.42	-1.76	0.71	-13.23	11.80	9.97	1.23	7.17
	Y	6.80	-2.95	-3.60	3.48	-3.39	4.39	5.59	3.58	3.96
2. Jowar	A	11.82	-1.14	-29.40	-1.29	-38.29	-25.96	-2.43	-10.18	-9.53
	P	-11.45	26.83	-49.24	18.11	-51.85	-3.99	-12.90	-6.38	-15.80
	Y	-20.81	28.29	-28.10	19.66	-21.97	29.67	-10.74	4.23	-6.94
3. Bajra	A	2.11	-4.32	0.13	-1.43	-28.45	-11.59	-2.11	-11.10	-6.35
	P	-8.93	3.10	-64.85	14.26	-32.25	-18.52	-10.35	-2.94	-11.12
	Y	-10.81	7.73	-64.90	15.92	-5.31	-7.84	-8.42	9.18	-5.10
4. Maize	A	12.10	-0.54	2.02	4.84	-11.82	-5.16	4.83	0.19	2.59
	P	9.84	-2.15	26.88	41.72	-4.91	-3.56	3.63	10.14	2.42
	Y	-2.02	-1.62	24.36	35.18	7.83	1.68	-1.15	9.93	-0.17
5. Wheat	A	2.26	-1.85	-0.23	3.43	-0.74	2.85	0.41	2.01	1.25
	P	-3.16	4.25	-0.90	7.88	-7.91	7.22	-1.20	5.10	2.14
	Y	-5.30	6.22	-0.67	4.31	-7.22	4.25	-1.61	3.03	0.88
6. Barley	A	-13.82	-1.39	-9.63	-18.62	0.43	-10.94	-10.91	-11.66	-10.21
	P	-8.12	-16.31	-16.81	-5.20	-5.78	-8.58	-11.44	-6.29	-9.79
	Y	6.62	-15.13	-7.95	16.50	-6.17	2.64	-0.60	6.07	0.46

Contd....

Table 3.3 (Contd....)

0	1	2	3	4	5	6	7	8	9	10
7. Gram	A	7.67	1.60	-2.32	-22.82	-10.05	-1.28	-0.54	-14.40	-4.86
	P	0.22	13.82	0.57	-0.0001	-15.01	-22.24	-0.93	-10.54	-5.28
	Y	-6.93	12.02	2.96	29.57	-5.52	-21.22	-0.40	-4.51	-0.45
8. Pulses	A	1.29	1.47	-3.03	-18.89	-11.46	5.05	-1.47	-12.96	-4.59
	P	2.06	7.23	-5.69	4.44	-14.91	-12.14	-0.60	-10.04	-4.49
	Y	0.76	5.68	-2.74	28.78	-3.90	-16.36	0.88	3.35	0.11
9. Total Food- grains	A	3.11	0.62	-0.75	-1.30	-5.00	2.92	0.38	-1.03	0.18
	P	-0.001	4.97	-0.35	8.04	-8.60	7.10	0.06	3.94	1.76
	Y	-3.02	4.33	0.40	9.47	-3.79	4.07	-0.31	5.02	1.58
10. Total Oil Seeds	A	-8.75	-15.13	-15.31	-0.53	20.22	17.53	-8.40	5.84	-3.51
	P	-32.51	13.48	-12.06	-0.42	39.03	9.25	-14.21	7.12	-4.79
	Y	-26.04	33.71	3.83	0.11	15.65	-7.04	-6.35	1.21	-1.33
11. Sugarcane	A	-3.33	0.74	-0.31	8.89	0.04	1.27	1.35	5.94	2.14
	P	-2.07	-0.78	-0.65	13.21	0.66	-4.03	3.36	7.38	4.27
	Y	1.30	-1.51	-0.34	3.96	0.61	-5.23	1.99	1.36	2.08

Note : A = Area; P = Production; and, Y = Yield.

UTTAR PRADESH
GROWTH IN AREA UNDER MAJOR CROPS
1951-52 - 1980-81

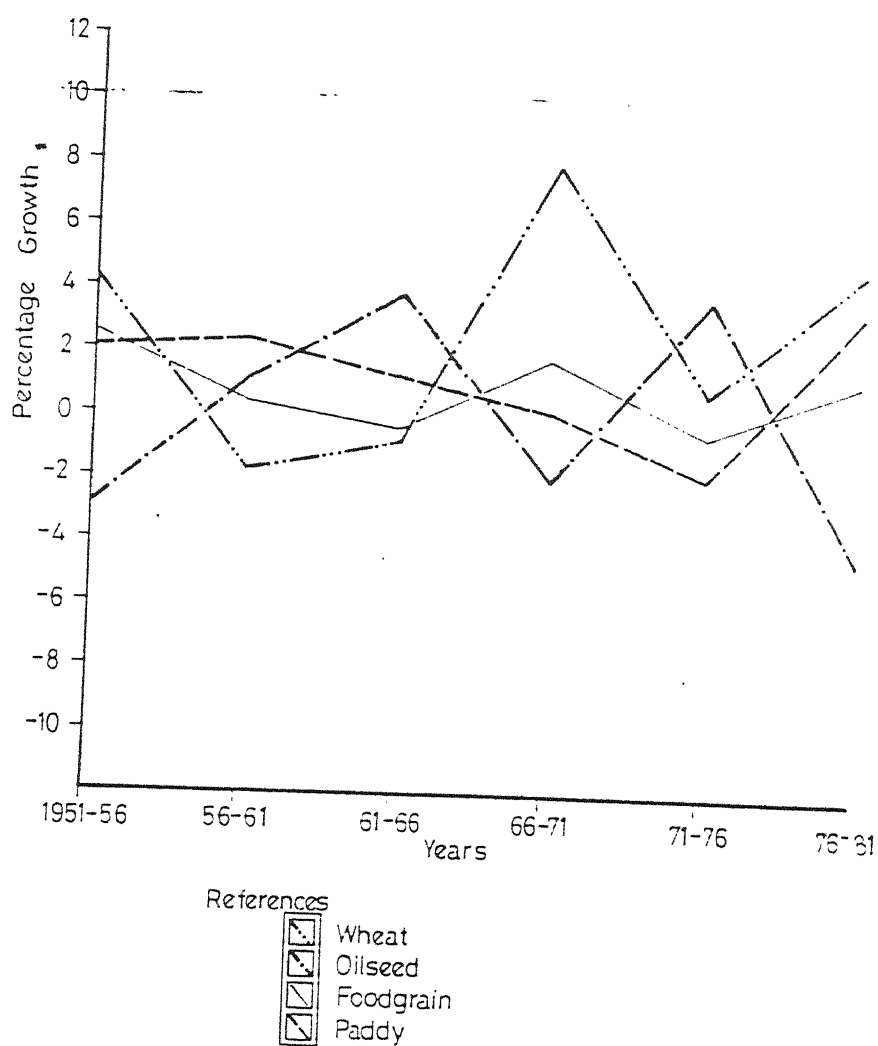


Fig. 3-F1

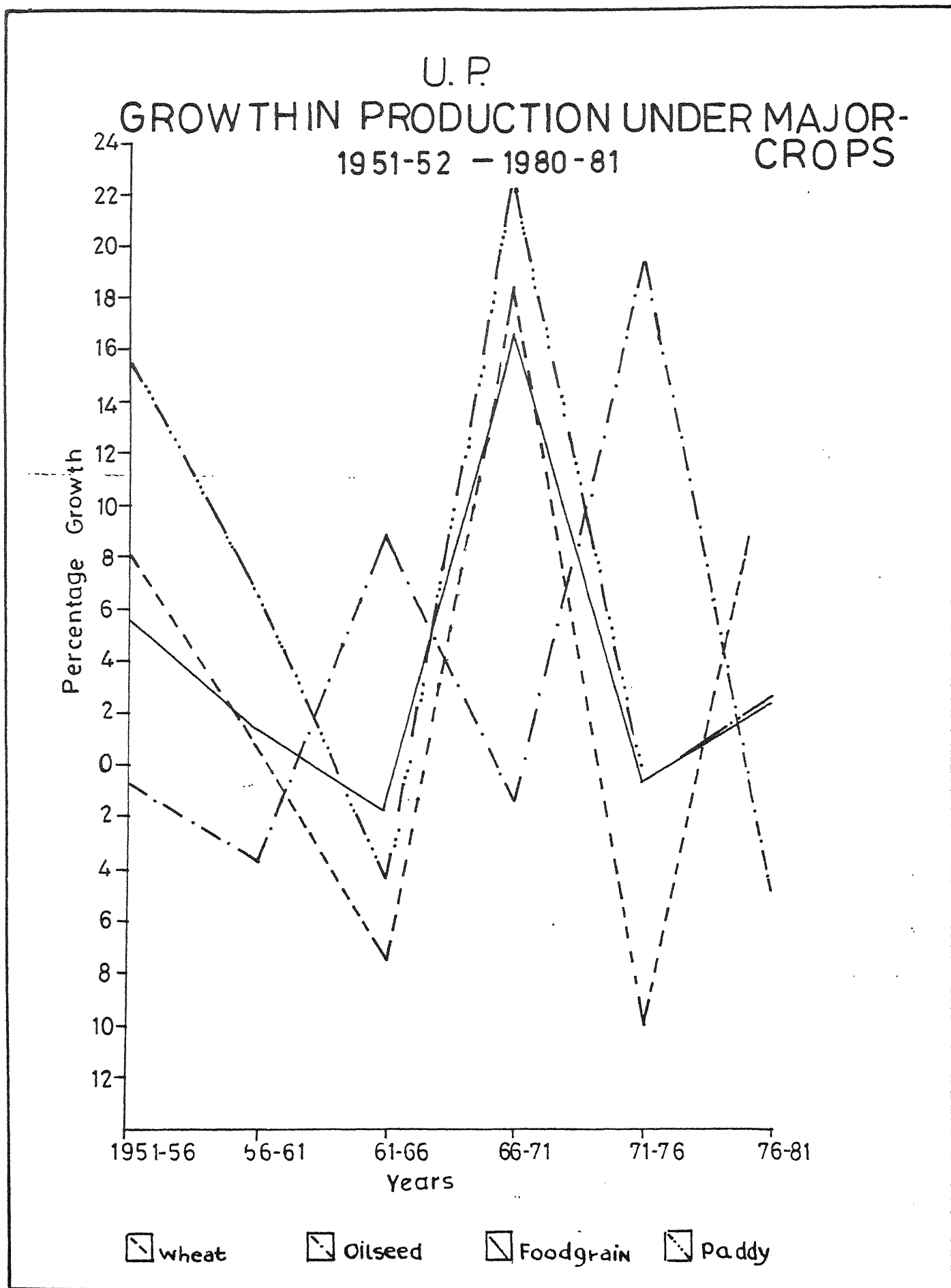
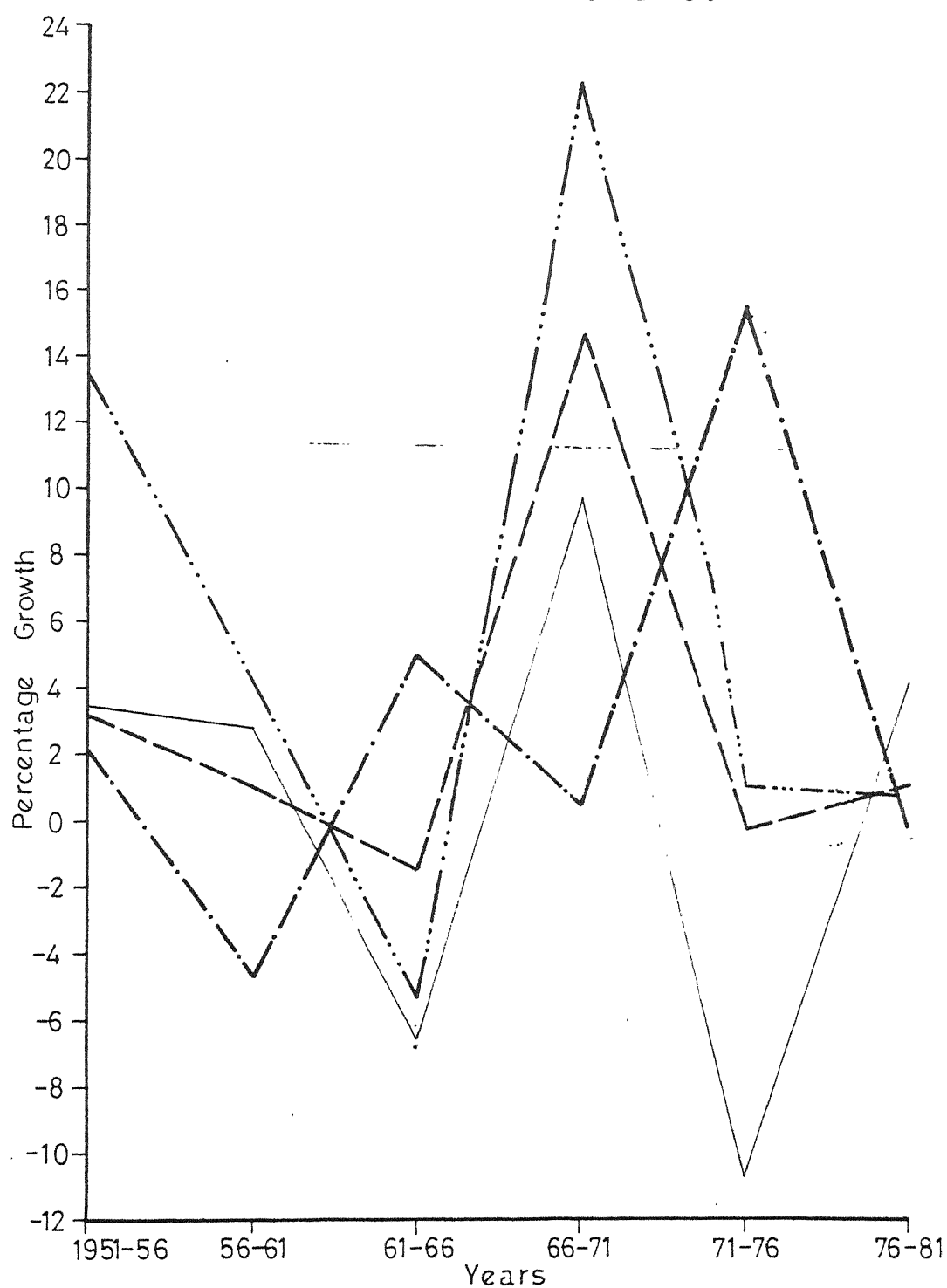


Fig. 3-F-2

UTTAR PRADESH
GROWTH IN YIELD UNDER MAJOR CROPS
1951-52 — 1980-81



References

- Wheat
- Oilseed
- Foodgrain
- Paddy

FIG 3-F3

U.P. : WESTERN REGION
GROWTH IN AREA UNDER MAJOR CROPS
1951-52 — 1980-81

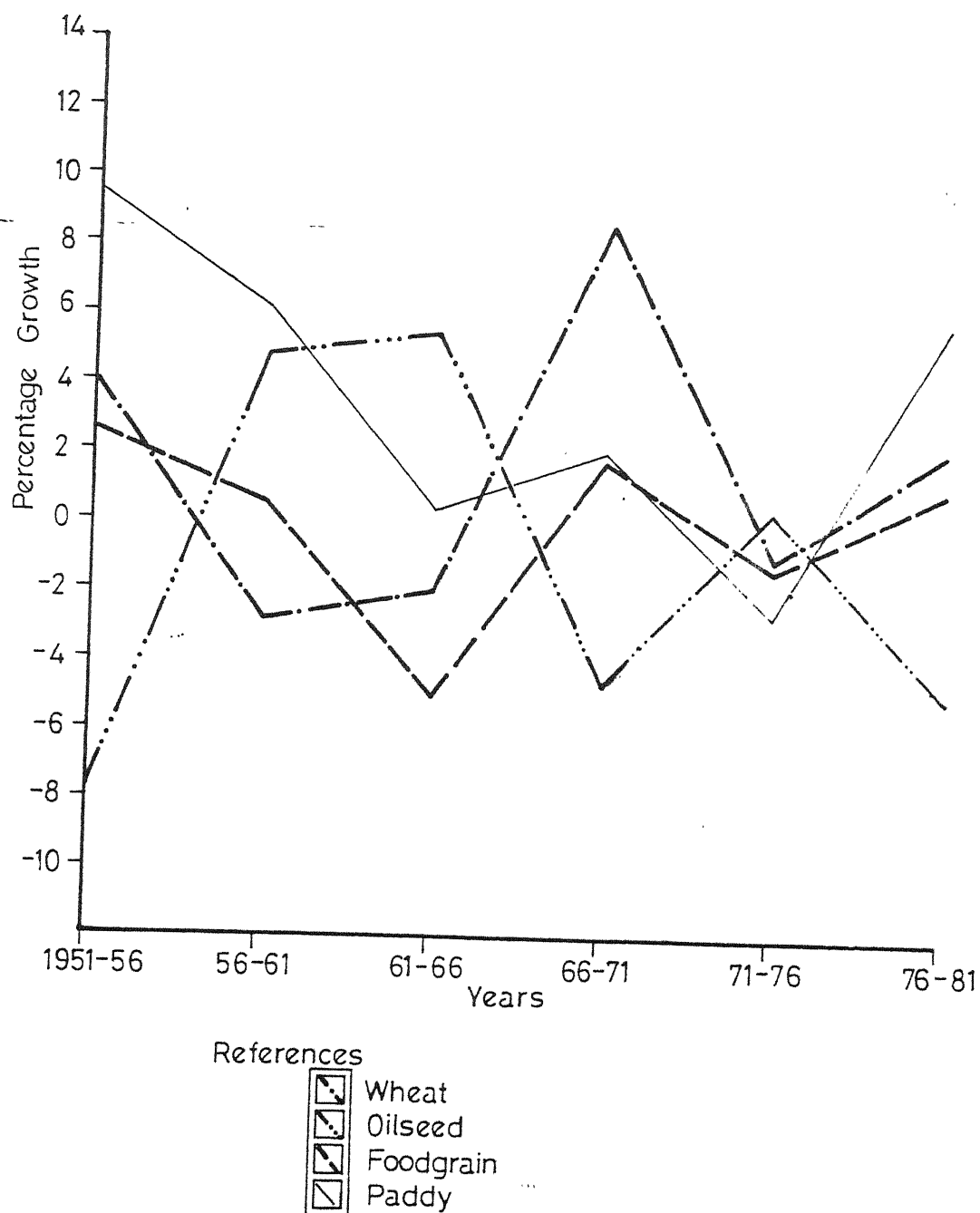


Fig. 3F4

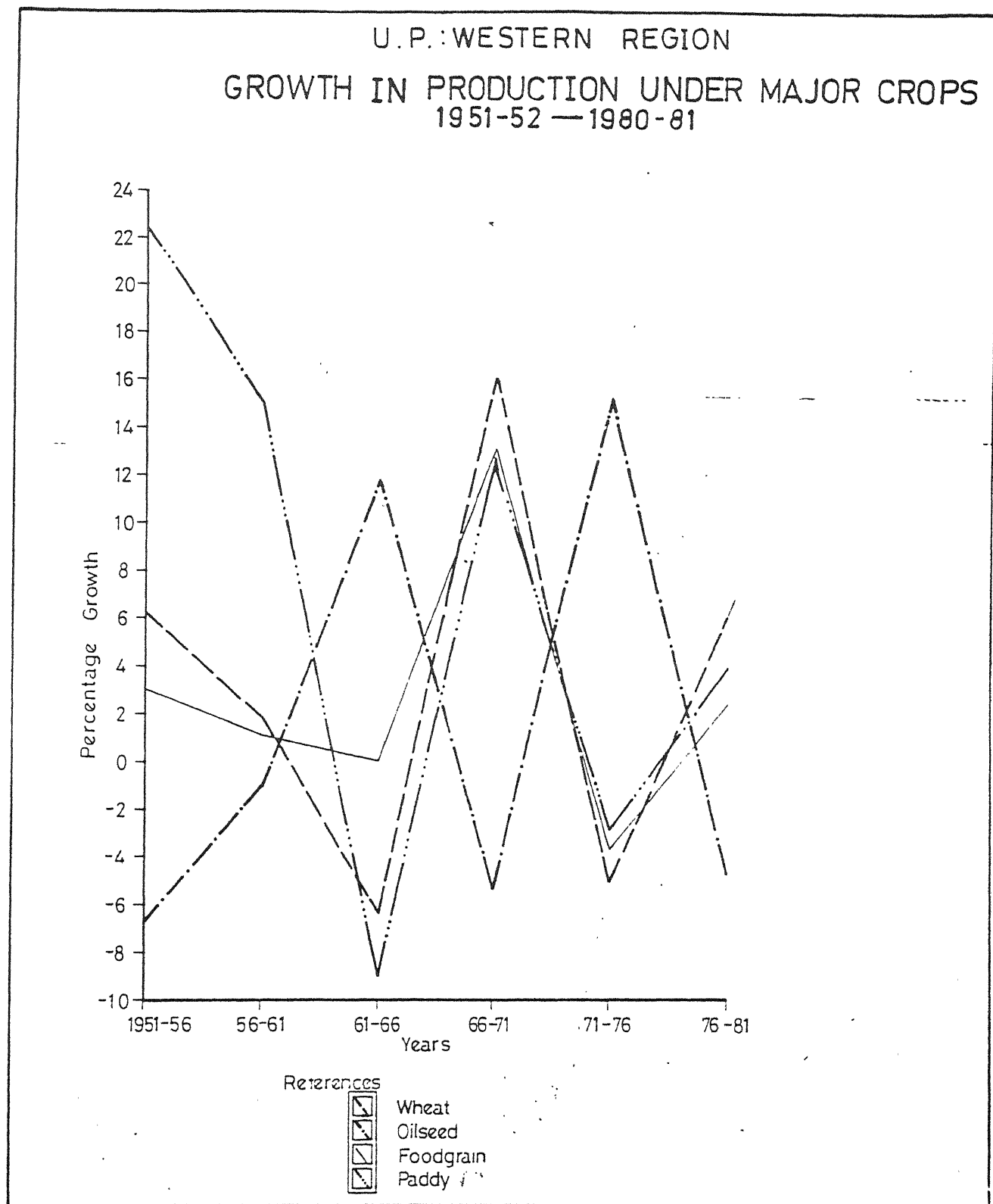


Fig. 3F-5

U.P.: WESTERN REGION
GROWTH IN YIELD UNDER MAJOR CROPS
1951-52 — 1980-81

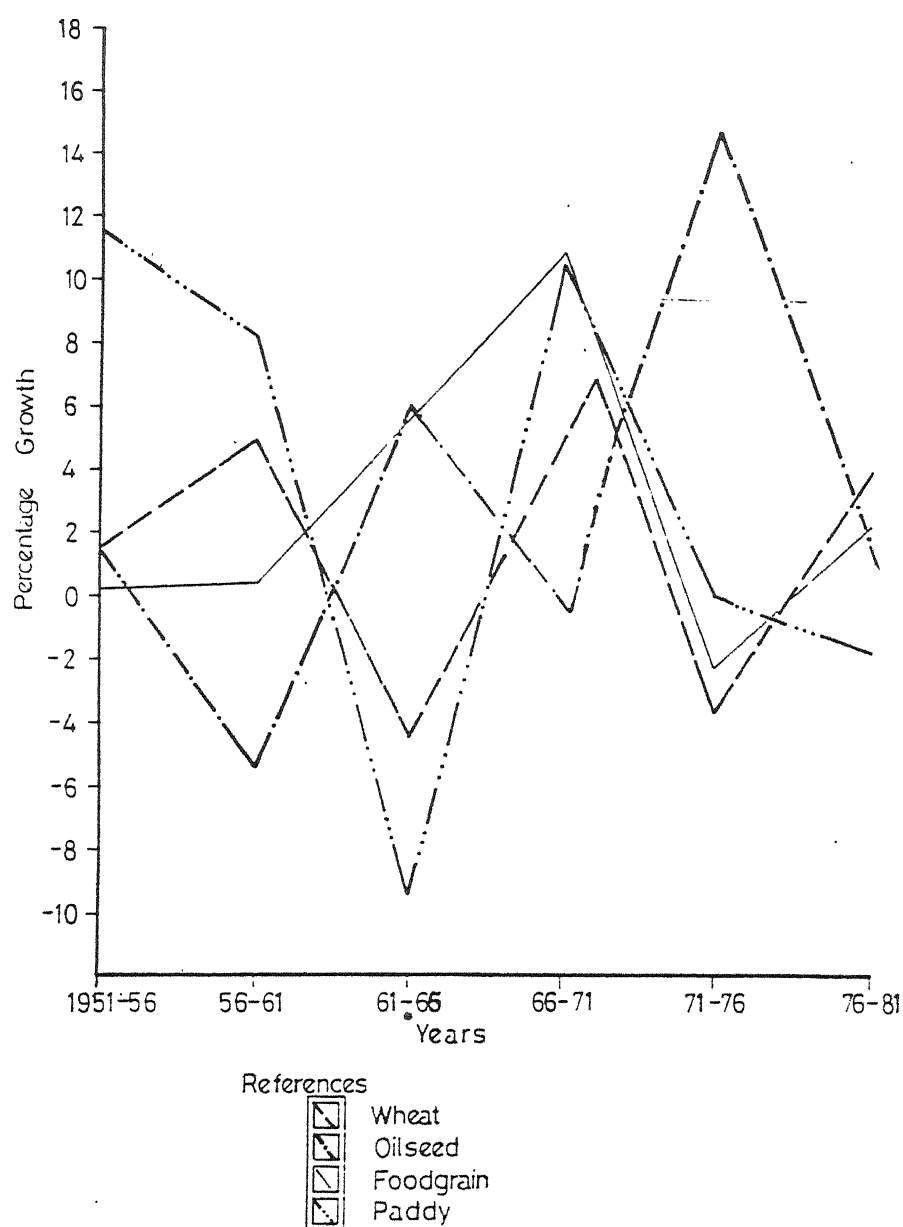


Fig. 3F-6

EASTERN REGION GROWTH IN AREA UNDER MAJOR CROPS 1951-52 — 1980-81

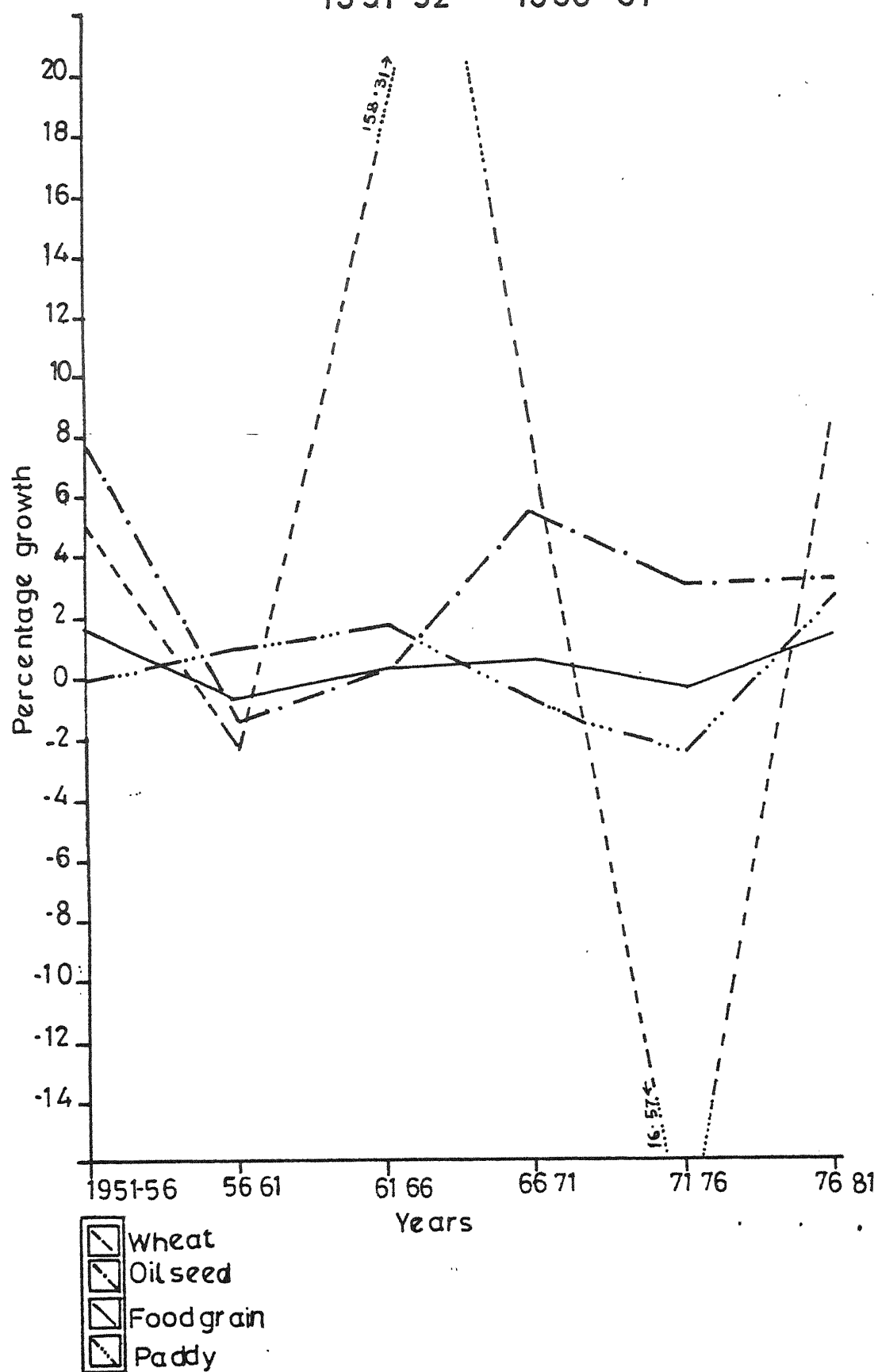


Fig. 3-F-7

EASTERN REGION
GROWTH IN PRODUCTION UNDER MAJOR CROPS
1951-52 — 1980-81

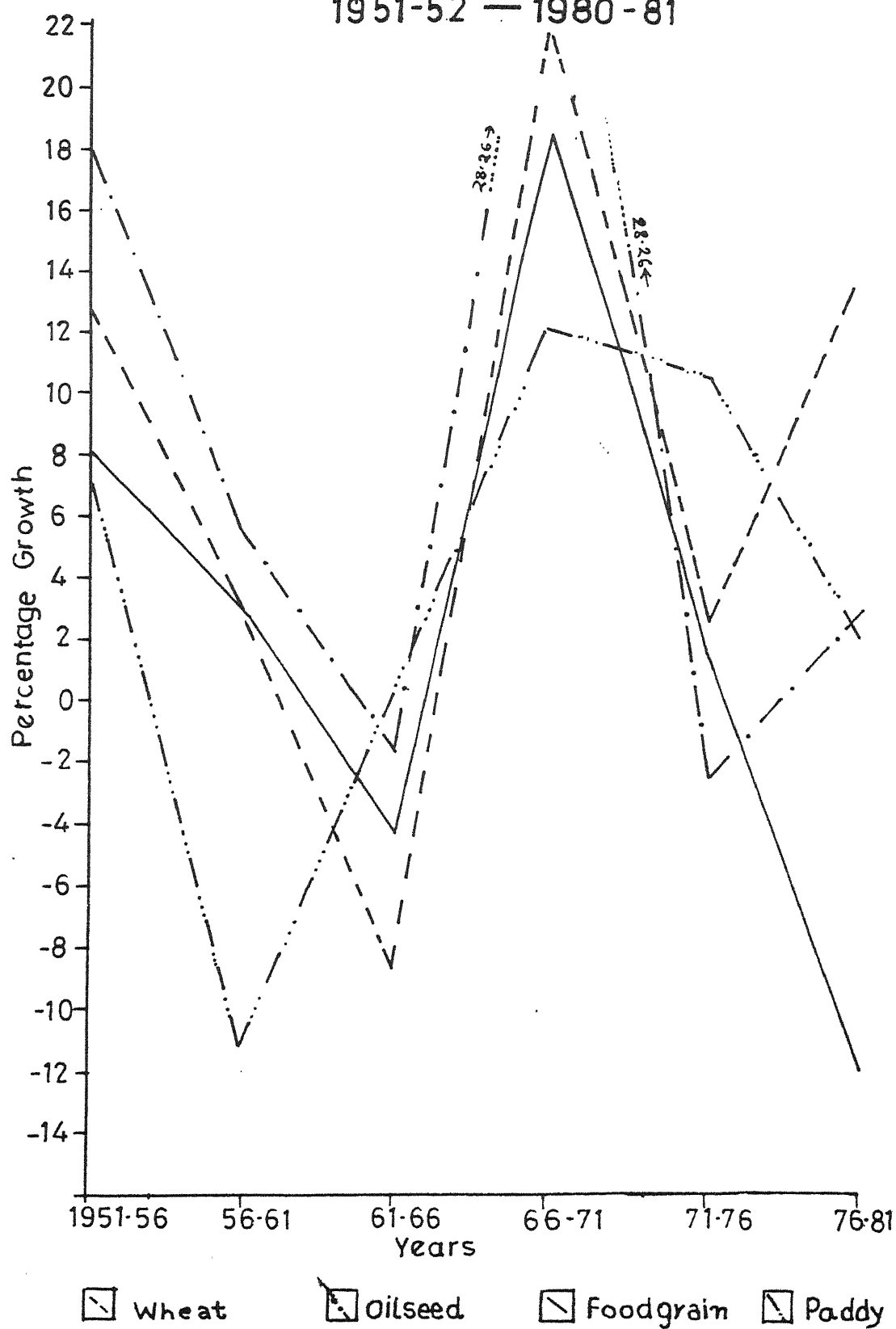


Fig. 3-F8

EASTERN REGION

GROWTH IN YIELD UNDER MAJOR CROPS

1951-52 — 1980-81

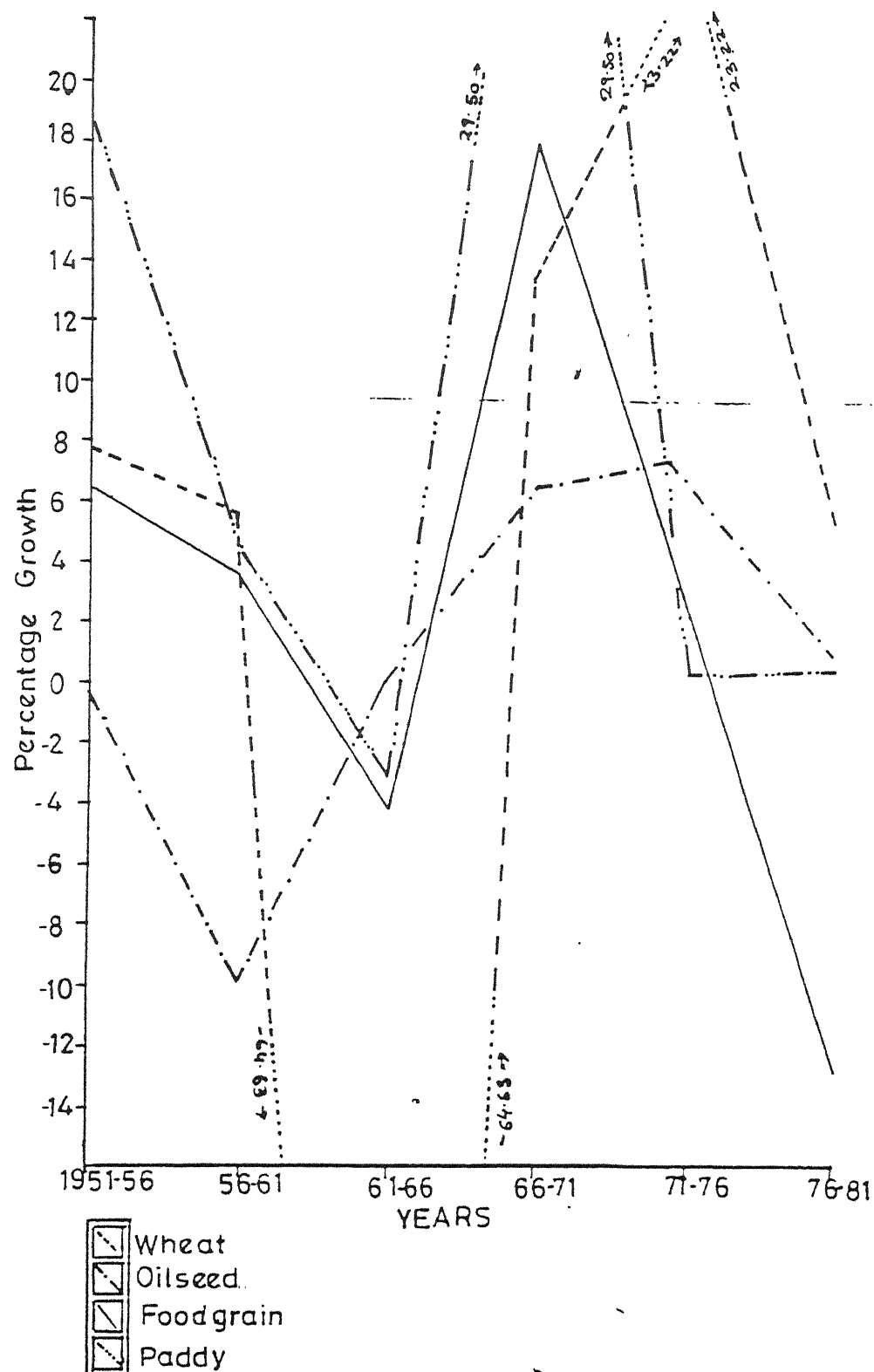


FIG.3F9

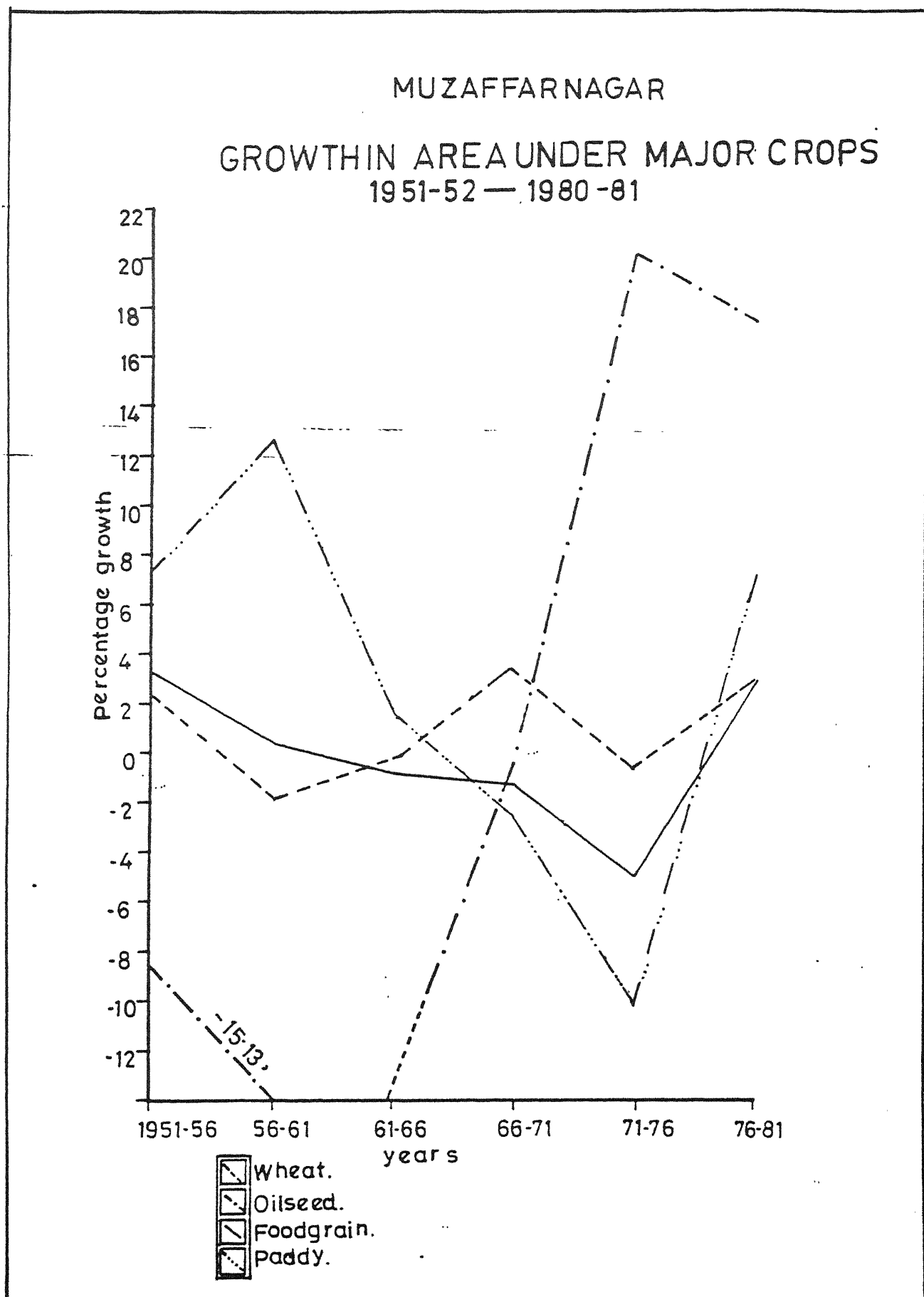


Fig. 3-F-10

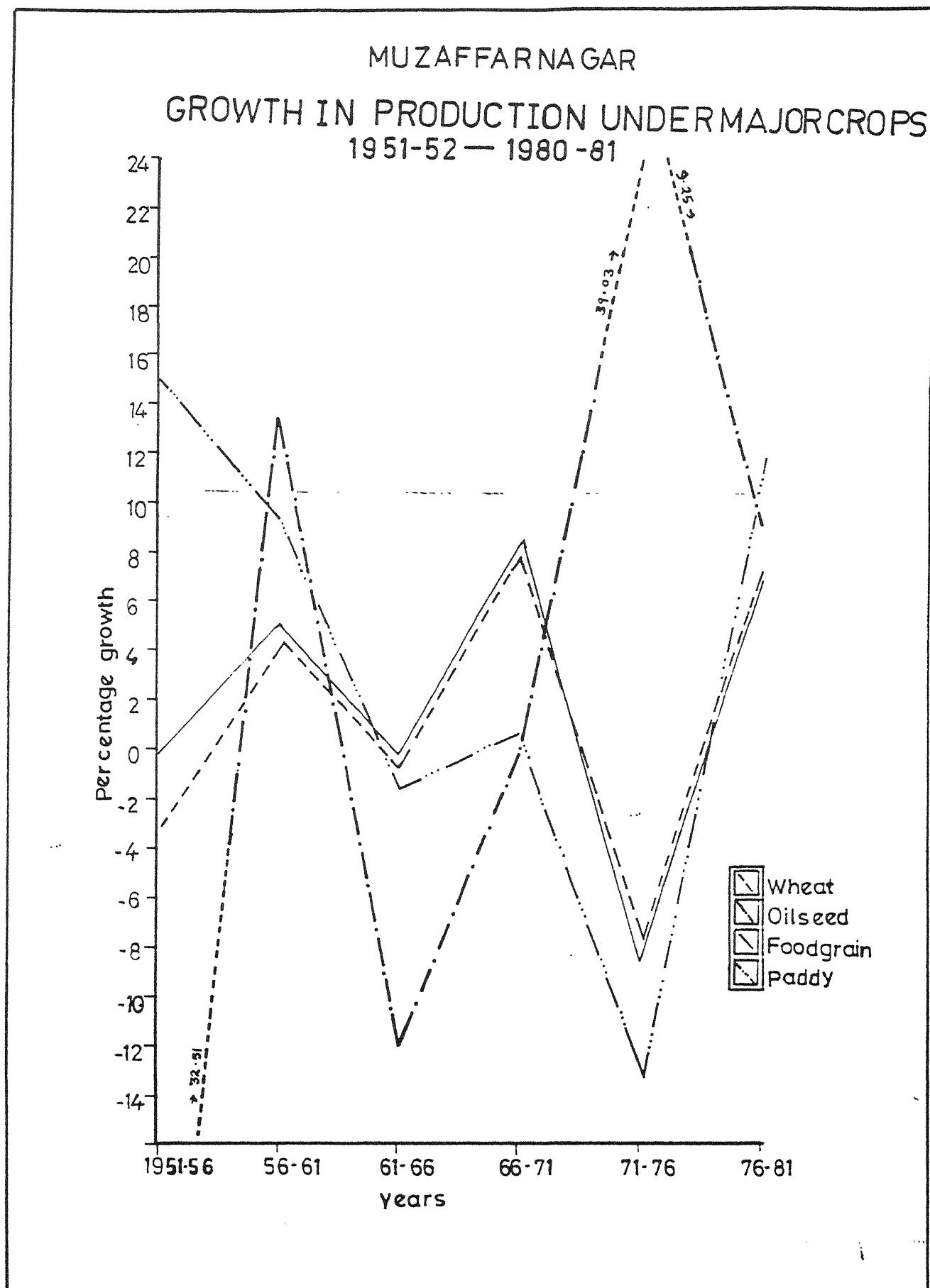


Fig. 3-F-11

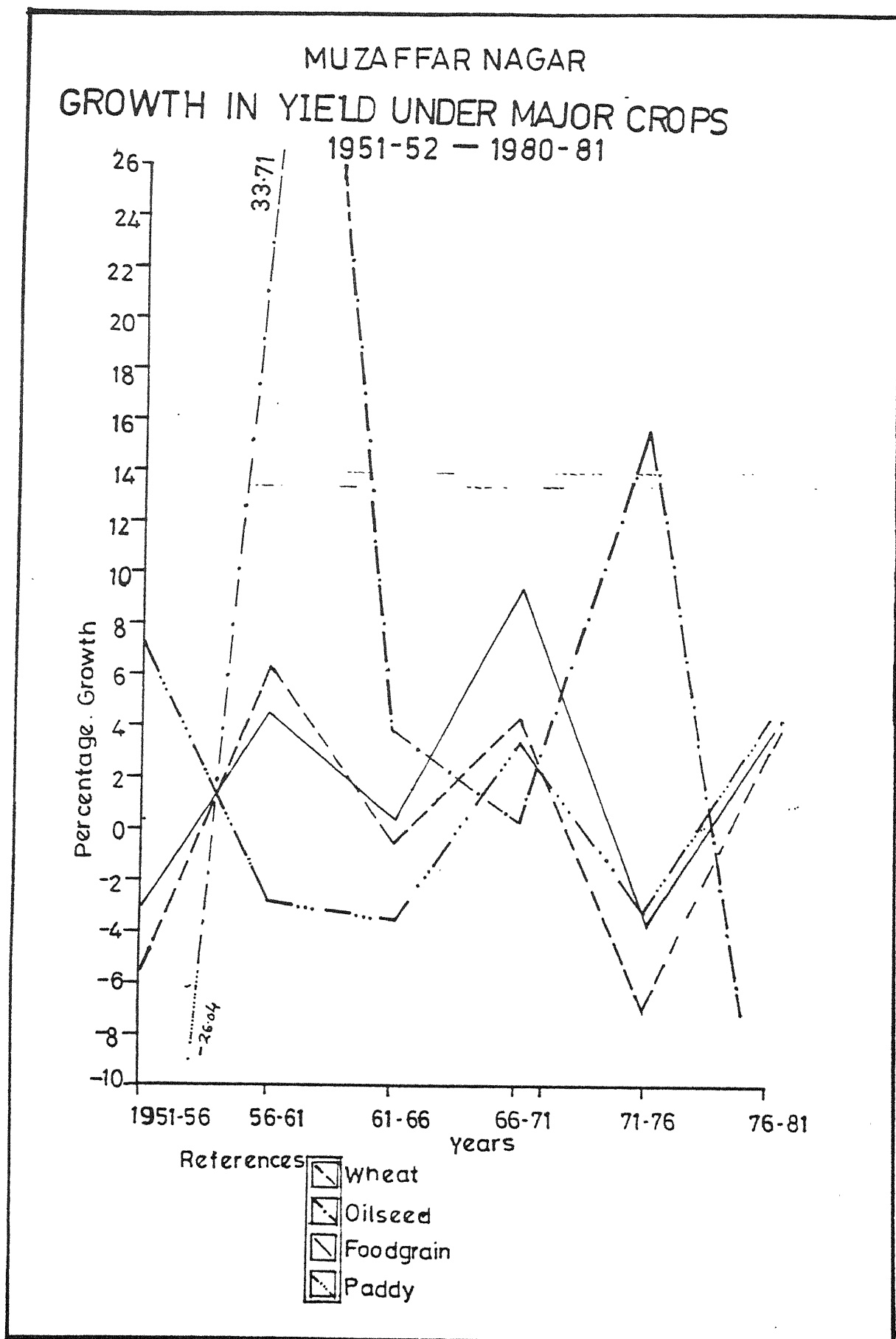


Fig. 3-F-12

DISTRICT-GORAKHPUR
GROWTH IN AREA UNDER MAJOR CROPS
1951-52 — 1980-81

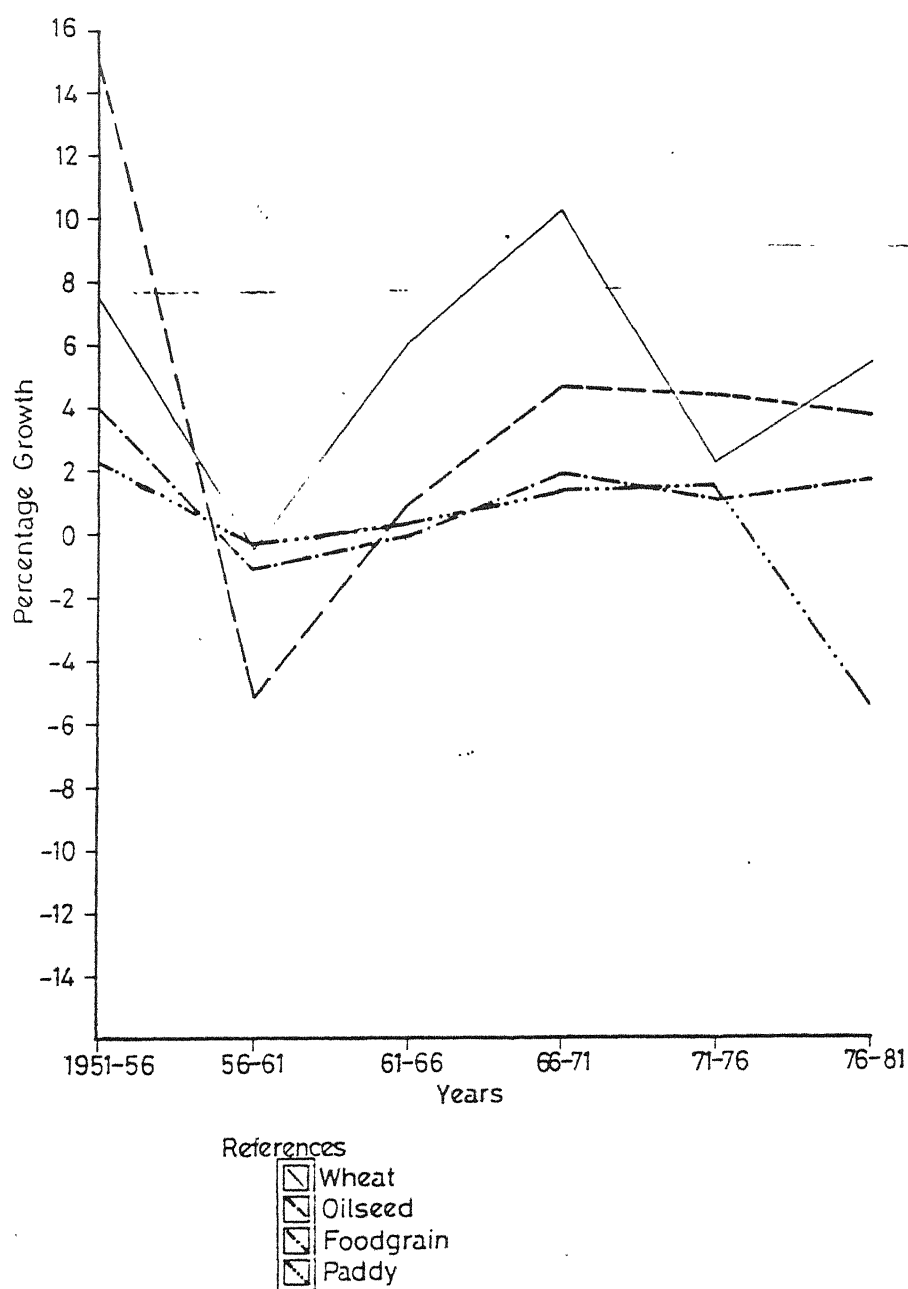


Fig. 3-F-13

.DISTRICT - GORAKHPUR
GROWTH IN PRODUCTION UNDER MAJOR CROPS
1951-52 — 1980-81

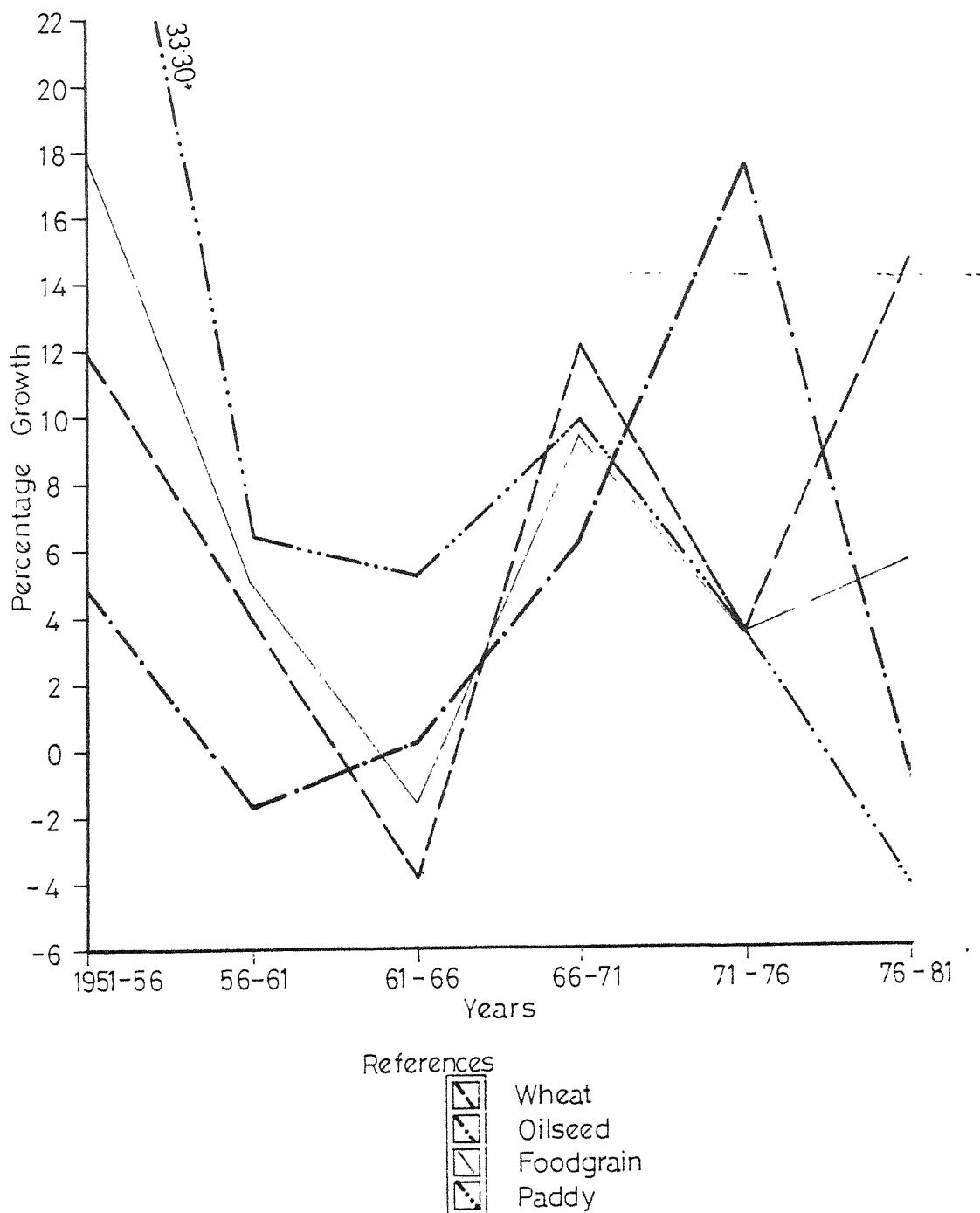


Fig. 3-F14

DISTRICT - GORAKHPUR GROWTH IN YIELD UNDER MAJOR CROPS 1951-52 — 1980-81

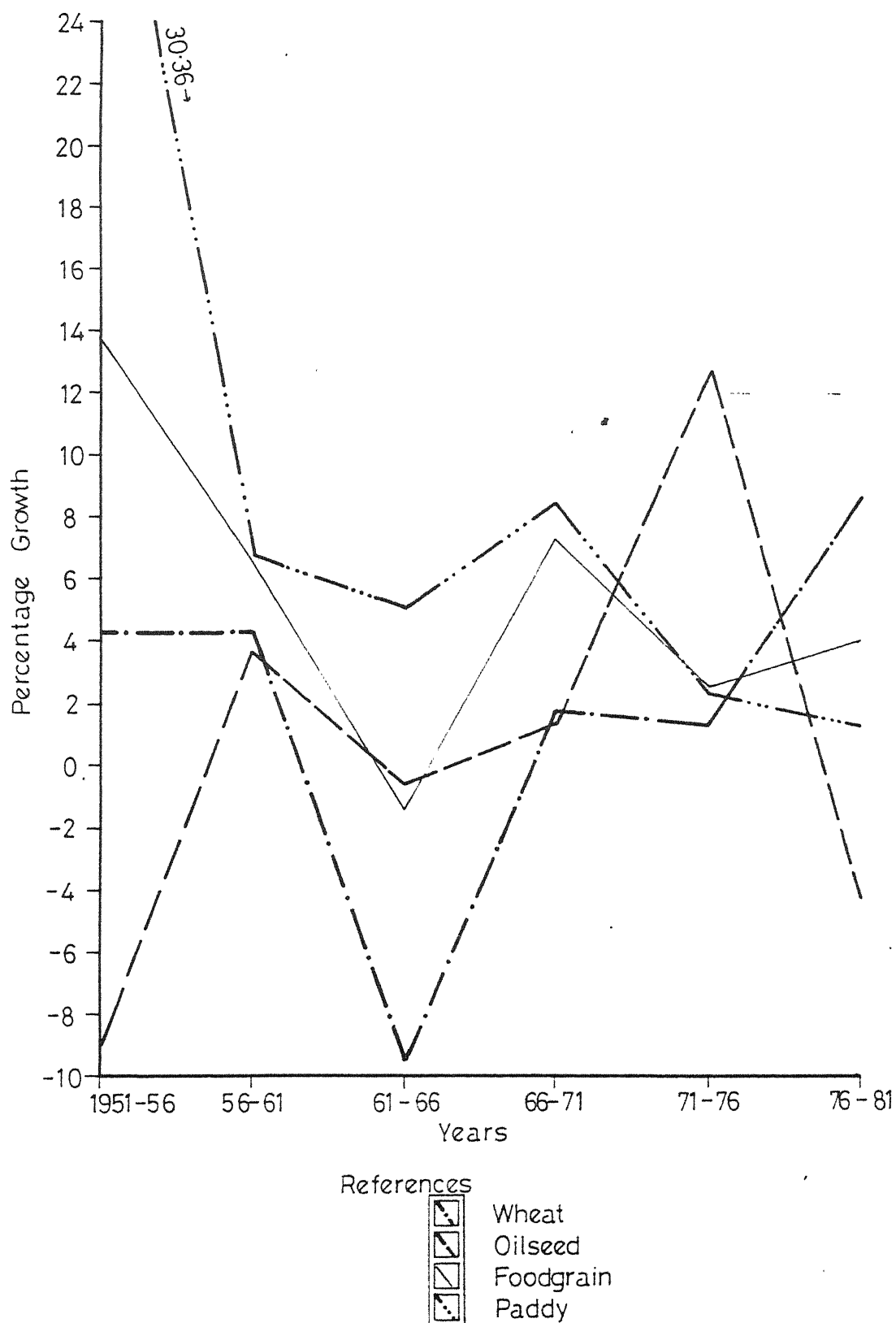


Fig. 3-F-15

Chapter IV

MODERNISATION, GROWTH AND OCCUPATIONAL DIVERSIFICATION IN U.P. AGRICULTURE

Rationale underlying the suggestion for modernisation of agriculture is that it leads not only to agricultural growth but also results in occupational diversification of rural economy. It removes agricultural backwardness and so agrarianism which stands as a stumbling block on the way to process of growth. This type of reasoning presupposes the positive relationship between modernisation, growth and occupational diversification in agriculture. In the present chapter, an attempt is made to establish the relationship, if there is, any, between modernisation, growth and occupational diversification in U.P. agriculture to 1980-81 during 1956-57/using multivariable regression analysis.

The chapter is divided in three parts. The first part presents a review of numerous studies on the question of modernisation and growth in agriculture. In second part an attempt has been made to discuss the relationship between modernisation and growth and in third part, the relationship between growth and occupational diversification. The relationship between modernisation and growth is discussed on the assumption that output growth in

agriculture is a function of change in output per hectare; and so the latter is taken as a dependent variable. The relationship between agricultural growth and occupational diversification is examined on the assumption that (a) growth leads to increase in agricultural or farm income, (b) an increase in farm income raises the demand for non-agricultural commodities and services and consequently, non-farm activities grow and expand; and (c) expansion of non-farm activities leads to employment in the non-agricultural sector. Hence it is hypothesised that growth and occupational diversification are positively related.

PART I

Review of Literature

There is not much divergence of opinion about the contribution of modernisation to agricultural productivity. A country whose major portion of foreign exchange was spent on the import of foodgrains, has now reached a stage from which it is helping the needy friendly countries. Substantial changes have occurred in the farm productivity, cropping pattern and in the use of modern agricultural

technology.¹ Modernisation has raised agricultural productivity and total production in the country, but its impact has been uneven.² A number of research studies on spatial analysis show that there are wide regional variations in the levels and growth of agricultural output as well as in the use of inputs in various districts and States of India.³ It is held that modernisation has touched only a few selected regions and crops of the

¹Singh, Sita Ram; "Technological Changes Parameters in Agricultural Productive Function", Ashish Publishing House, 8/81, Punjabi Bagh, New Delhi, 1986.

²(a) Rao, C.H. Hanumantha; Technological Change and Distribution of Gains in Indian Agriculture", Macmillan, 1975, pp.175-178. (b) Kahlon, A.S; Green Revolution - Some Lessons from Indian Experience, Agricultural Situation in India, April, 1976, pp.3-5. (c)

³(a) Ladejnsky, Wolf; Ironies of India's Green Revolution, Foreign Affairs, July 1970, pp.758-68. (b) P.S. Sharma, Regional Variations in Rice Economy in India, Indian Journal of Regional Science, Vol.5, No.2, 1973, pp.126-146. (c) B.S. Rao and P.V. Sharma; Regionalisation for Growth and Balance in the Agricultural Sector, Indian Journal of Regional Science, Vol.XII, No.11, 1980, pp.101-114. (d) Dharam Narain, Growth of Productivity in Indian Agriculture, Occasional Paper No.93, Cornell University Ithaca, New York, June 1976. (e) G.M. Desai & G. Singh; Growth of Fertilisers in Districts of India-Performance and Policy Implications, Indian Institute of Management, Memo, 1973, p.15. (f) Prasad, D.S; The HYV Phase in India : Trends in Rice Yields and Institutional Aspects, Unpublished Ph.D. Thesis submitted to Andhra University, 1980.

country, modern technology is being adopted only by big landlords resulting into inequality of rural income. Some people are not sure even with the tempo of the revolution and fear that agriculture may be back to old technology if change in technology is not followed by changes in rural organisation.⁴

A number of studies on various aspects of agricultural modernisation have been undertaken in India. While some have tested the farm efficiency and examined the size productivity relationship,⁵ others have analysed the impact of Green Revolution on employment in farm

⁴Ghosh, R.N; Agriculture in Economic Development with special Reference to Punjab, Vikas, New Delhi, 1977, p.73.

⁵(a) Sankhyan, P.L; Size of Holding and Productivity - A Case Study of Punjab, ASI, March 1978, pp.773-775. (b) Chaddha, G.K; Farm Size and Productivity Revisited, Some Notes from Recent Experience of Punjab, EPW, (Review of Agriculture), September 30, 1978, ppA-87 - A-96. (c) Rao, C.H. Hanumantha (1964); Alternative Explanations of the Immense Relationship between Farm Size and Output per Acre in India, Indian Economic Review. (d) Bhatia, S.S; Spatial Variations, Changes and Trends in Agricultural Efficiency in U.P. 1953-63, IJAF, January-March, 1967. (e) Saini, G.R; Farm Size, Resource Use Efficiency and Income Distribution, Allied Publishers; Bombay, 1979.

sector.⁶ Some others have examined the influence of technological factors on different size group of farm.⁷

⁶(a) Agarwal, P.C; The Green Revolution and Rural Labour, Sri Ram Centre for Industrial Relation and Human Resource, New Delhi, 1973. (b) Wills, I.R; Green Revolution and Agricultural Employment and Incomes in Western U.P., EPW, (Review of Agriculture), March 27, 1969, pp. A2-A10. (c) Billings, M.H. & Singh, A; Labour and the Green Revolution : The Experience in Punjab, EPW (Review of Agriculture), December 27, 1969, pp.221-A224. (d) Laxminarayan, H; Changing Conditions of Agricultural Labours, EPW, October 22, 1977, pp.1817-1820. (e) Acharya, S.S; Impact of Technological Change on Farm Employment and Income Distribution Division of Agricultural Economics, Indian Agricultural Research Institute, New Delhi, 1972. "Green Revolution and Farm Employment", Indian Journal of Agricultural Economics, July-September 1973, pp.30-45. (f) Measurement of Direct and Indirect Employment Effects of Agricultural Growth with Technical Change, Employment in Developing Nations, Report on a Ford Foundation Study, ed. E.O. Edwards, Columbia University Press. (g) Raj, K.N; Mechanisation of Agriculture in India and Sri Lanka (Cylon), Mechanisation and Employment in Agriculture - Case Studies from Four Continents, ILO, Geneva, 1973.

⁷(a) Ojha, G; Small Farmers and HYV Programme, EPW, April 4, 1970, pp.603-605. (b) Harrison, J. ; Agricultural Modernisation and Income distribution - An Economic Analysis of the Impact of New Seed Varieties on Crop Production on Large and Small Farmers in India, Dissertation Abstracts, 33(10) : 5376-A, 1972. (c) Selvaroj, P; and Arputharoj, C; Is Green Revolution Scale Neutral? Southern Economist, November 15, 1975, pp.7-9.

Jussawala,⁸ the Board of Economic Enquiry Punjab,⁹ Schiller,¹⁰ Faulkner, Reed and Brown,¹¹ Giles,¹² and Gupta¹³ suggested that agricultural productivity and farm income were positively associated with mechanised cultivation.

Jussawala (1949) observed that the yield per acre increased in Government owned experimental farms minimum by 40 per cent following mechanisation of farming operations.

⁸Jussawala, Mehroo; Mechanisation of Agriculture, Indian Journal of Agriculture Economics, Vol.4, No.1, March 1949, pp.145-158.

⁹Board of Economic Enquiry, Punjab; Economics of Tractor Cultivation in Punjab, Publication No.60, Controller of Printing and Stationary, Punjab, Chandigarh, 1960. Economics of Tractor Cultivation in Punjab, 1957-58, Publication No.62, 1961.

¹⁰Schiller, Otto, Modern Agriculture in Small Holdings-Experience in West Germany, Indian Journal of Agricultural Economics, Vol.14, No.4, December 1959, pp.47-53.

¹¹Faulkner, M.D; Reed, G.W. and Brown, D.D; Report of Government of India on Increasing Milling Out turn of Rice from Paddy in India, Ford Foundation, New Delhi, September, 1963.

¹²Giles, G.W; Report on Agricultural Power and Equipment Sub-panel 3, Manufactured, Physical and Biological Inputs, World Food Society, November 1966.

¹³Gupta, Madan Lal; A Case Study into the Economic Potentialities of Tractor Cultivation in the Punjab, M.Sc. Thesis (Unpublished), College of Agricultural University, Ludhiana, 1966.

The Board of Economic Enquiry, Punjab (1956-57) suggested that the returns per worker on a family farm (per day and per year) were four times higher for tractor cultivated holdings than that for bullock cultivated farms.

Schiller (1959) observed that in spite of preponderance of small and medium sized farms in Western Germany, mechanisation increased agricultural production manifold during the post-War period.

Faulkner, Reed and Brown (1963) suggested to the Government of India to increase yield of edible rice from paddy via mechanical threshing of the crop at the optimum moisture content, bulk handling, off-farm mechanical dryers and fully protected scientific storage outside the farm.

Giles (1966) observed that preliminary analysis indicated a positive relationship between crop yield and the horse-power available per hectare. He indicated that the power and equipment inputs should be of the kinds that would contribute to increased yields as a first priority.

Gupta (1966) applied budgeting technique to explore the possibilities of increasing farm income on a 25 acre bullock operated farm through the introduction of tractor cultivation in Galib Kalan village of Ludhiana district. The author concluded that it was profitable to switch over from bullock to the tractor.

The above studies found a positive relationship between agricultural productivity and mechanised cultivation. Yet, there are a few studies which concluded that mechanisation did not bring about substantial changes in agricultural productivity and farm income.

The Board of Economic Enquiry, Punjab (1957-58) found that there were no significant differences in incomes and expenditures per acre of tractor cultivated and bullock cultivated holdings.

Hawkings¹⁴ (1964) observed that while tractors ploughed deeper, experiments had shown that they did not necessarily increase yields.

¹⁴Hawkings, T.C; Cultivation with Tractor Implements, Souvenir Issued on the Occasion of the First Annual Ploughing Championship, Agricultural Machinery Association of India, New Delhi, December, 1964, pp.17-29.

Bina Agrawal¹⁵ (1983) demonstrated that output per hectare of gross cropped area was positively related to the expenditure on fertilisers and manure as well as to the percentage of gross cropped area irrigated, and negatively related to the size of the area cropped in Punjab. The use of tractors and tubewells, in comparison with bullocks and canals respectively was not found to affect the gross yield. While examining wheat specific yield effects of mechanisation, she suggested that unlike the neutral effect of tractor-use on wheat yield the use of tubewells in comparison with canals was found to have a significant positive effect. This was largely because tubewell enabled the farmer to have a better control over the quantum and the timing of irrigation than was possible with canals. The factors other than tubewell irrigation, which were found to affect yield were expenditure on fertilisers and manure, expenditure on seeds and the agro-climatic zones to which plot belonged. The overall variation between farms in the yield of HYV wheat

¹⁵ Agarwal, Bina; Mechanisation in Indian Agriculture : An Analytical Study based on the Punjab, Allied Pub. Pvt. Ltd, New Delhi, 1983.

was found to be low. Similarly, the elasticity coefficients of the significant explanatory variables were also found to be low. She, therefore, concluded that the yield of HVT wheat in Punjab appeared to have reached a plateau and the scope for further increases through existing inputs appeared to be limited.

Bisaliah¹⁶ (1984) demonstrated of 36.5 per cent increase in per acre output of wheat in Ferozepur district, 10 per cent was attributable to gain in efficiency (technical change), and 27.3 per cent was attributable to increased use of labour, fertiliser, irrigation and capital per acre.

Gupta¹⁷ (1985) asserted that cropping intensity, irrigation, HVT and fertilisers have played an important role in increasing productivity per unit of net area sown in Haryana.

¹⁶Bisaliah, S; Contribution of Irrigation to Output and Employment Growth under New Wheat Production Technology, The Asian Economic Review, Vol. XXVI, Nos. 1 & 2, April and August, 1984.

¹⁷Gupta, D.P; Agricultural Development in Haryana, Agricole Publishing Academy, New Delhi, 1985.

Sita Ram Singh¹⁸ (1986) applied aggregative production function technique to explain the impact of various factors on output in Darbhanga district of Bihar and concluded that output was largely explained by labour, a non-technological factor and the role of technological variables was secondary. Technological factors together explained merely 15 per cent variation in gross total output. Among the technological factors output was found to be largely responsive to chemical fertilizers, followed by HYV seeds. Irrigation was not found to be a significant variable affecting the output. The crop-wise production function revealed that some of the technological factors like irrigation and HYV seeds were also important in some crops like wheat and potato etc.

Nalini Govind¹⁹ (1986) observed that fertiliser consumption per hectare and proportion of rice area irrigated were the two variables which explained positively and significantly yield levels in most of the regions in

¹⁸ Ibid Singh, 125

¹⁹ Nalini, Govind, Regional Perspectives in Agricultural Development, Concept Publishing Company, New Delhi, 1986.

India, both during 1967-68 and 1970-71. The same was true in case of all regions taken together. She indicated that, all the variables except percentage of area under High Yielding Variety influenced wheat yields positively but only two variables namely, pumpsets and wheat area irrigated improved the R^2 square value in 1967-68 while in 1970-71, fertiliser consumption per hectare, tractors (per thousand hectare), pumpsets, and irrigated area were significantly associated with yield in wheat regions of India taken together.

Suryanarayana Raju²⁰ (1987) observed that resource base infrastructure (percentage of net irrigated area to net area sown, number of tractors per lakh of population, oil engines and electric motors per lakh of population, road mileage per lakh hectares and percentage of electrified villages and towns to total number of villages and towns etc.), input use (percentage of gross irrigated area to gross cropped area, intensity of cropping, fertilisers used per hectare of cropped area and credit availability per hectare) and productivity are related to each other.

²⁰ Suryanarayana, Raju; S.D.V; Analysis of Productivity Levels and Economic Efficiency in Agriculture, Chugh Publications, Allahabad, India, 1987.

The above mentioned studies clearly demonstrate that there is a positive relationship between modernisation and agricultural growth which occurs as a sequence to increase in output. It is a commonly held view now that agricultural growth can be accelerated further only through rational modernisation since there is very limited scope for an increase in area under cultivation.

The numerous studies has been conducted to measure the level and impact of agricultural modernisation. But most of these studies are specific in nature in the sense that either they tried to gauge the level and extent of modernisation or analysed the impact of one or some specific aspect of modernisation (i.e. mechanisation, fertiliser consumption, irrigation or area under HYV) on agricultural productivity or growth. With a few exceptions, one finds almost a complete absence of studies to analyse the overall effect of modernisation on agricultural growth; and most prominently comparative study of two different areas or regions. Most of the studies based upon secondary data and tabular analysis give only a general outline of the impact of modernisation in agriculture. In India where agricultural conditions

are highly variable, such studies assume relatively greater importance. In the present chapter we, therefore, attempt to analyse the impact of modernisation on agricultural growth in Gorakhpur, Muzaffarnagar districts and Eastern, Western regions of Uttar Pradesh.

PART II

Specification of Variables and Methodological Design

The following indicators have been taken together to show the magnitude of modernisation in agriculture:

1. Percentage area irrigated by tubewells
2. Agricultural machinery per hectare
3. Area under HYV
4. Fertilizer consumption per hectare
5. Cropping intensity
6. Percentage area irrigated under the crop

The list of factors that are considered to be relevant in showing the magnitude of modernisation in agriculture as given above is in no way exhaustive and many other factors could have been considered. We have, however,

limited our analysis for consideration of these factors on the assumption that land augmenting technological change matters most in the context of agriculture and these variables are important component of this technological change. Moreover, availability of data on these variables is not a constraint.

Area irrigated by tubewells that includes its major part irrigated by private tubewells, reflects some degree of investiveness on the part of farmers; i.e. induced investment. Such induced investment also indicates (or measures) farmer's progressiveness or for that matter, change-in production relations. Hence a positive relationship between yield and area irrigated by tubewells is expected at least in certain crops.

Agricultural machinery (pumpsets and tractors) per hectare of cultivated land refers to mechanisation in agriculture. It is supposed to be accompanied with land augmenting technological change and on the other hand, it also reveals public and private investment. Here also we expect the positive relationship between growth and this variable.

Agricultural productivity is closely associated with high Yielding Varieties of seeds at least in certain crops where high yielding varieties of seeds are available and used. The use of HYV seeds requires controlled water supply and they are very responsive to fertiliser use.

The fertiliser consumption is expected to be positively related to yield in all crops in general and highly associated in positive way to yield under crops with HYV seeds like wheat and paddy because the new HYV seeds are responsive to chemical fertilisers.

Cropping intensity is supposed to be affected by the use of new technology (HYV seeds, fertiliser-consumption etc.). We, therefore, expect a positive association between cropping intensity and yield.

The yield per hectare depends not only on the above mentioned variables but also on the availability of irrigation facilities. With availability of irrigation water, crops which require more investments and yield more incomes are grown since irrigation ensures certainty in production. The use of HYV seeds and fertiliser depends

upon the availability of irrigation. Thus a positive association is hypothesised between yield and irrigated area. Percentage area irrigated to total cropped area has been used in case of oil seeds, maize and food-grains where the data for area irrigated under the crops was not available for the desired period. But this replacement would not affect the results since we are not making the inter-crop comparisons.

Multiple linear regression model is fitted to the above mentioned data for the period 1956-57 to 1980-81. The entire period has been divided further in two sub-periods; 1956-57 to 1965-66 (i.e. pre-Green Revolution period), and 1966-67 to 1980-81 (i.e. post-Green Revolution period). Rationale underlying this division of the whole period is that the new technology (fertiliser responsive HYV seeds, pesticides etc) was introduced in agriculture since the mid-sixties which brought about a radical change in agricultural sector, especially raising the yield levels in some particular crops like wheat, paddy and maize. We, therefore, expect the measures of modernisation to have more close association with yield during post-Green Revolution period than during to the pre-Green Revolution period.

All the indicators of modernisation are common for both the periods except area under HYV seeds which was introduced since 1965-66 onwards, and therefore it is available only for the post-Green Revolution period. Owing to this discrepancy, the regression results have been arranged in three different sets. In the first instance, the results have been worked out with common indicators for both before and after-Green Revolution periods and referred to as first phase and second phase respectively for the analytical convenience. We now added area under HYV to common indicators of modernisation and worked out another set of results for the post-Green Revolution period and this has been termed as third phase. The multiple linear regression model is fitted to observe the relationship between yield and modernisation for the six crops namely sugarcane, wheat, paddy, oil seeds, maize in particular and foodgrains in general at State (U.P.), region (Eastern and Western) and district (Muzaffarnagar and Gorakhpur) levels.

The model used for analysis is as follows :

$$Y = A + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 \quad \dots\dots$$

where, Y = Yield per hectare

- x_1 = Area irrigated by tubewells
- x_2 = Agricultural machinery per hectare
- x_3 = Area under HYV seeds
- x_4 = Fertiliser consumption per hectare
- x_5 = Cropping intensity
- x_6 = Area irrigated under the crop

A and b's = Parameters to be estimated

The Regression Results

The results of the regression analysis are arranged in Tables 4.1, 4.2 and 4.3. Our regression model significantly explains the relationship between yield levels for the crops and various modernisation indicators in U.P. during the first phase 1956-57 to 1965-66 where we have 83.6%, 80.7%, 66.8%, 63.70% and 60.90% explanation in terms of R^2 values for the crops like foodgrains, wheat, oil seeds, sugarcane and paddy respectively. It is interesting to note that the explanatory power of the same set of variables sharply declines for all crops during the second phase 1966-67 to 1980-81, when the area under HYV is excluded. But with the addition of the area under HYV to the given set of variables, we observe that the R^2 value significantly improves specially

in case of paddy, and foodgrains in the State since 1966-67 to 1980-81. In case of maize, the R^2 value also improves with the HYV inclusion in the post-Green Revolution period. However, the inclusion of HYV does not make much difference to the level of explanation particularly in case of wheat, as it renders only 55 per cent explanation. The inclusion of the HYV variable in the set of indicators does not make much difference to oil seeds and sugarcane in the post-Green Revolution era. But the regression results obtained in before and after Green Revolution with and without HYV variable, explain that the introduction of HYV seeds improves the level of explanation significantly, particularly in case of paddy and total foodgrains. Keeping in view, the fact that fertiliser responsive HYV seeds are effective only when there is assured supply of water, paddy is grown in rainy season when farmers do not face the water crisis due to rains while wheat crop is grown during winter season and farmers have to depend upon canals and other irrigation system which is not developed sufficient enough to meet out the water requirements of the crops grown in season. There is always crisis of irrigation. The inadequate irrigation facilities prevent the farmers to use

proper doses of fertiliser for achieving higher yield level in wheat crop. Our model reported a very low level of explanation for maize and it is only because we are still far behind in terms of coverage under HYV maize.

The results presented in Table 4.1 make it clear that the adoption of HYV varieties of seeds has brought about some amount of stability in crop yields. Had it not been such case, there could be some kind of declining State, as phase two indicates; if compared with phase three.

The region-wise regression results presented in Table 4.2 indicate that in case of Eastern and Western regions, the choosen indicators provide sufficiently higher level of explanation for yield levels but this association is revealed clearly during post-Green Revolution period when level of explanation is higher than the first phase of 1956-57 to 1965-66 in Western and Eastern regions. Another noteworthy point is that the level of explanation is higher in Western region than in Eastern region for almost all the crops. When we include HYV seeds in our analysis, the level of explanation increases in both regions which demonstrates the

importance of HYV seeds for raising the yields in crops like wheat and paddy. It may be noted here that the regression analysis presents 56 per cent explanation for maize in Western region during second phase, while level of explanation is only 35.9 per cent in Eastern region. It is because the coverage under HYV maize is higher in Western region.

We have very good explanatory power for paddy, wheat and foodgrains in the district of Gorakhpur during the period 1956-57 to 1965-66. The explanatory power declines significantly in case of paddy while that of maize improves during the second phase 1966-67 to 1980-81. The inclusion of HYV seeds in the model improves the situation with increased R^2 values in the third phase. It shows that HYV technology has some built-in stability in crop yields, otherwise there could have been the situation as the R^2 values obtained in the second phase without HYV presented in Table 4.3 indicates.

The level of explanation is lower in Muzaffarnagar than in Gorakhpur for all the crops, except sugarcane during the first phase. But during the second phase our

model explains 87%, 73% and about 80% contribution of modernisation indicators toward yields in paddy, wheat and foodgrains. The introduction of area under HYV in regression model for the period 1966-67 to 1980-81 further improves the level of explanation in almost all the crops taken into consideration. This further suggests that the impact of high yielding varieties of seeds on agricultural productivity is higher in Western region of the State of U.P. It indicates that in parts or areas where assured water supply and better water use is a reality, the responsiveness of HYV technology to yields would be higher as the regression results in case of Muzaffarnagar obtained in the second phase shows. On the whole, the regression results show that the indicators of modernisation considered in this chapter have significant explanatory power. However, the effectiveness of these variables in yield growth varies from one region to another and one district to another at the inter-regional level.

F Statistics also suggest that model is fit to explain the relationship between dependent and independent variables particularly during 1966-67 to 1980-81. During first phase of 1956-57 to 1965-66 F value is significant

at 5 per cent level in case of foodgrains and that too in district Gorakhpur only. That the F value is insignificant for all crops under consideration in U.P. It is significant at five per cent and at one per cent level for paddy and wheat in Eastern region and at one per cent level for both paddy and foodgrains in Western region while level of significance is 5%, 1%, 5% and 1% for paddy, wheat, maize and foodgrains respectively in Gorakhpur district and 1%, 5% and 1% for paddy wheat and foodgrains in Muzaffarnagar district during second phase 1966-67 to 1980-81. Our regression model explains the relationship between yield and independent variable in terms of F statistics which is significant at 1% for paddy and foodgrains in the State as a whole, at 1%, 5% and 5% for paddy, wheat and oil seeds in Eastern region and at 5%, 5%, 5% and 1% level for paddy, wheat, oil seeds and foodgrains respectively in Western region while F value is significant at 5%, 5% and 1% level for wheat, maize and foodgrains in Gorakhpur and 1%, 5% and 1% for paddy, wheat and foodgrains respectively in Muzaffarnagar after the inclusion of area under HYV during 1966-67 to 1980-81.

mc

t Values relating to individual significance of various measures of modernisation to yield levels in different crops also suggest the positive relationship between modernisation and growth. As expected the area irrigated by tubewells is significant at 5% level and positively related with yield in wheat in the State of U.P. during first phase 1956-57 to 1965-66. Although insignificant during second phase it is significant at 1% level and has a negative sign which speaks of the reverse relationship between yield and area irrigated by tubewell in paddy during third phase and therefore, deserves the explanation. Traditionally the paddy cultivation has been a major staple kharif crop in Eastern U.P. and constitutes a major chunk of total area under paddy cultivation in the State. Eastern region is plagued by heavy floods, waterlogging and **salienity** which ultimately either wipes out the crop or makes it extremely difficult to adopt new techniques of production and even if one applies it results in poor paddy yields. In Eastern region it is insignificant in first two phases and significant at 5% level bearing a negative sign in paddy during third phase. The same explanation is applicable in this case also as given for State.

Area irrigated by tubewells is negatively associated with maize yield and significant at one per cent and five per cent level during second and third phase respectively in Gorakhpur which is not unexpected. It is significant at ten per cent level and has a positive association with wheat yield during the first phase 1956-57 to 1965-66 in Gorakhpur while in Muzaffarnagar its value of coefficient is insignificant through all phases.

There is positive relationship between paddy yield and agricultural machinery per hectare and highly significant at 1 per cent level in U. P. during third phase. Agricultural machinery has a negative association with maize yield and significant at 5 per cent level in Western region during second and third phase simultaneously while coefficient of variation is significant at the ten per cent level with a negative sign with yield in sugarcane during third phase in Western region.

The use of fertilizer responsive high yielding varieties of seeds with assured water supply has been the essence of new technology introduced in mid-sixties. The results of our regression model, in this respect, are what we expected. The fertilizer consumption per hectare has a positive

association with yield and significant at 5 per cent, 10 per cent, 10 per cent and 5 per cent level in paddy, wheat, foodgrains and sugarcane crops during second phase in Eastern region while it is negatively related with wheat yield during first phase and significant at ten per cent level. There's nothing unusual since farmers, in that early period dependend entirely upon the mercy of nature for water, and fertilizer application resulted in lower crop yields. Fertilizer consumption has a negative association with yield in oilseeds and significant at five per cent level while its association with yield in sugarcane is positive and significant at ten per cent level only in Eastern region during third phase.

Model has reported a positive relationship between fertilizer consumption and yield in paddy, wheat and foodgrains which is significant at five per cent level in Western region during the second phase. The nature of relationship between fertilizer consumption and yield is found to be positive in wheat and foodgrains and significant at 5 per cent and one per cent level while it is negative and significant at five per cent level in oilseeds in Western region during third phase.

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Fertiliser application is reported to be positively associated with yield levels in wheat, maize, foodgrains and sugarcane and significant at 5%, 10%, 10% and 5% respectively in district Gorakhpur during the second phase. The association is found to be positive in wheat and sugarcane crops while negative in case of oil seeds in Gorakhpur during third phase.

On the other hand the relationship between yield and fertiliser application in case of total foodgrains is reported to be positive and significant at 10 per cent during the third phase only in district Muzaffarnagar.

As per our expectations a positive relationship is reported between cropping intensity and yield in paddy and total foodgrains and significant at one per cent and five per cent level respectively in Uttar Pradesh during third phase while cropping intensity is negatively related with total foodgrains yield but significant at 10 per cent level only during first phase. It is obvious since during first phase higher cropping intensity, in absence of proper irrigation facilities, high yielding varieties of seeds and fertiliser use, resulted in declining yield.

In Eastern region we find a positive association between cropping intensity and yield in oil seeds during third phase. The nature of relationship is positive for maize crop and significant at five per cent level during both second and third phase in Western region. It has a positive relationship with yield in foodgrains and oil seeds also and significant at five per cent level during third phase in Western region.

Cropping intensity has a positive association with yield in paddy and wheat having a significance level of five per cent while it is inversely related with yield in maize with 5% level of significance in district Gorakhpur during second phase. Though our regression model reported a negative sign with maize, yield in

Gorakhpur district it is positively related with maize yield in Western region during third phase. The explanation is simple enough to grasp. The availability of assured water supply makes it possible for the farmers, in Western region, to use fertiliser responsive high yielding varieties of seeds to attain higher yield levels in maize and thus the use of new technique of maize cultivation is more than to compensate the decline in soil

fertility on account of increase in cropping intensity. Our regression model gives a positive relationship between cropping intensity and yield in paddy during third phase in Gorakhpur district.

Cropping intensity reveals a positive association with yield in paddy through all phases in Muzaffarnagar. Its association with yield is positive in wheat having 10% level of significance during second phase while a negative relation significant at 10% level is reported in case of sugarcane in the same district during third phase.

The regression equation establishes a positive relationship between percentage area irrigated under the crop with yield in wheat and total foodgrains having five per cent and ten per cent level of significance during first phase in U.P. Irrigated area reported a positive association with yield in sugarcane also and is significant at five per cent level during second and third phase respectively.

There is a negative association between irrigated area and yield in paddy in Eastern region during second and third phase. It is negatively associated with yield

in sugarcane also but significant at 10 per cent only in the same region during third phase. The nature of association with yield is positive one and significant at 10% level in case of paddy and foodgrains and negative and significant at 10% level in case of oil seeds during third phase in Western region.

Percentage area irrigated under the crop shows a negative relationship with yield in oil seeds in Gorakhpur during third phase. It is positively associated with yield in foodgrains and significant at ten per cent level during first phase in Muzaffarnagar.

Our model explains that relationship between area under HYV and paddy yield is positive one and highly significant at one per cent level in U.P. during 1966-67 to 1980-81. Regression equation reported a positive association between area under HYV and yield in foodgrains and oil seeds also but with lower level of significance being 5% and 10% respectively. The positive relationship between dependant and independent variables in case of oil seeds implies that HYV oil seeds if developed and applied in agriculture, would have been very successful in Uttar Pradesh. The t values relating to HYV in case of oil seeds show its significant association with yield

in the State. It is interesting to note from the point of view of oil seeds output growth, if it is to be promoted in the State.

Area under HYV seeds revealed a direct relationship with yield in paddy and oil seeds in Eastern region and is significant at five per cent and at one per cent level respectively. It has a positive association with yield in total foodgrains and oil seeds having ten per cent and one per cent level of significance respectively in Western region.

In district Gorakhpur it depicts a positive association with yield in oil seeds and is highly significant at one per cent level while it demonstrates the positive relationship with yield in paddy and significant at 5% level in district Muzaffarnagar.

The regression analysis of factors determining the yield level in agriculture clearly demonstrates that there is a definite positive association between various indicators of modernisation and yield level at least in paddy, wheat, foodgrains and sugarcane at State, region and district level. Besides these crops our model has shown a positive impact of various indicators of modernisation on yield in oil seeds at all levels while

explanation for maize is found to be satisfactory in Western region only. It is to be noted that relationship between dependent and independent variables is more pronounced and clear during 1966-67 to 1980-81. Likewise the level of explanation is higher in district Muzaffarnagar and Western region than district Gorakhpur and Eastern region. This implies that new technology has been more effective in Western region than Eastern region. One of the major factors responsible for this is the recurring floods and waterlogging and lower availability of irrigational facilities in eastern region. The majority of farmers in the Eastern region is that of small and marginal land holders who are neither in a position nor willing to share the adoption of new agricultural practices due to lumpiness in investment. The investiveness of the farmers in Eastern region towards development of private means of irrigation and other agricultural practices has been found to be very low on account of prevalence of poor socio-economic conditions.

The preceding regression analysis clearly highlights that there is a positive association between modernisation and growth in agriculture. It may be said that modernisation leads to growth in agriculture and removes the

agricultural backwardness and so agrarianism which stands as a stumbling block on the way to the process of growth, However, the realisation of benefits from modernisation is limited to the conditions in which it is introduced and production takes place in area.

PART III

Growth and Occupational Diversification in Agriculture

In the foregoing chapter, we observed a significant rate of growth in U.P. agriculture. In previous section of this chapter we obtained a positive relationship between modernisation and growth in agriculture. Now we shall examine another important aspect of economic development i.e, 'Occupational diversification'. It is held that occupational diversification is natural outcome of economic development. The history of economic development around the World gives conclusive evidence that beyond a certain stage of development it becomes difficult to accelerate economic development unless the occupational patterns are diversified and the proportion of the workforce entirely dependent upon agriculture gets reduced over time. It is true that development of

agriculture is prerequisite for triggering off the economic growth but there is much evidence to show that the proportion of population depending upon agriculture is much less in agriculturally advanced regions than it is in less developed regions.

We expect that occupational diversification would take place in the following schematic way:

1. Agricultural growth leads to increase in farm sector income including wage income from agriculture.
2. Increase in farm sector income, in turn, raises the demand for non-agricultural commodities and services which would lead to expansion of non-farm activities.
3. Expansion of non-farm activities enhances the demand for labour i.e., labour (surplus and/disguised) will be transferred to non-farm sector.

Hence it is hypothesised that there is a positive relationship between growth and occupational diversification in agriculture.

In this part of the chapter, we analyse the type of relationship between growth and occupational diversification in Uttar Pradesh agriculture during the period 1961 to 1981.

For this, the proportion of agricultural workers to total workers has been taken as a dependent variable because any decline in it would suggest the increase in non-agricultural activities meaning thereby occupational diversification. We have chosen the following independent variables : (i) agricultural income per worker; (ii) area under commercial crops and (iii) proportion of non-agricultural income to total income.

We expect a negative association between proportion of agricultural workers to total workers and agricultural income per worker i.e. higher the agricultural income, lesser would be the proportion of agricultural workers to total workers and higher the occupational diversification and vice versa. It is so because any increment in agricultural income would result in higher demand for non-farm goods and services which in turn would lead to expansion of non-farm sector and thus facilitating the transfer of labour from agriculture.

The second variable i.e. the percentage area under commercial crops, is expected to be inversely related to proportion of agricultural workers to total workers. The proportion of non-agricultural income is also expected to be negatively associated with dependant variable.

Thus all the three independent variables are inversely related with proportion of agricultural workers to total workers implying that they should have a positive relationship with occupational diversification.

A multiple regression model is fitted to the above mentioned data for the period 1961 to 1981. The entire period has been divided in two sub-periods (i) 1961 to 1971 and 1971-to 1981. The independent variables are the same for both sub-periods. It may, however, be pointed out that we did not expect our model rendering adequate explanation during first sub-period 1961 to 1971.

A multiple regression analysis, carried out to establish the relationship between dependant and independent variables, has been restricted to State of U.P. only due to non-availability of data at region and district level. The multi-variable regression analysis has been based on the following model.

$$Y = a + b_1x_1 + b_2x_2 + b_3x_3$$

where, Y = Proportion of agricultural workers to total workers.

x_1 = Agricultural income per worker

x_2 = Area under commercial crop

x_3 = Proportion of non-agricultural income to total income.

a and b 's are regression coefficient.

The coefficients of multiple linear equations have been arranged in Table 4.4.

Our regression model does not clearly establish the relationship between dependant and independant variables during 1961-71. Though the regression equation gives about 63 per cent explanation in terms of R square value, of the effect of proportion of agricultural income per worker, area under commercial crops and proportion of non-agricultural income to total income on proportion of agricultural workers to total workers or occupational diversification. F statistics is also insignificant during sub-period 1961 to 1971. The coefficient of variation of proportion of agricultural workers to total workers is of positive nature and significant at 5 per cent level which is contrary to our expectations. This unusual phenomenon cropped up because both the proportion of agricultural workers to total workers and proportion of non-agricultural income to total income increased during the period 1961 to 1971. We, therefore, find the positive relationship during the decade 1961 to 1971.

We have fairly high level of explanation. Over 92 per cent of the association between dependant and independent variables during period 1971 to 1981. This fact is again supported by F statistics which is significant at one per cent level. Another fact that all three variables are significant at 1%, 5% and 1% level and inversely related to proportion of agricultural workers to total workers, leads to the same type of conclusion.

The results of our regression analysis clearly indicate that all the three independent variables i.e. agricultural income per worker, area under commercial crops and proportion of non-agricultural income to total income, are positively associated with occupational diversification. It implies that any increase in one or all the independent variables would result in a decline in proportion of agricultural workers to total workers and an increase in non-agricultural workers to total workers and vice versa.

Since the inception of planning in rural India, some planned efforts have been made to modernise agriculture. In this context, three sets of policy programmes launched

so far may be worth-mentioning. Firstly, intensive agricultural development programmes; secondly, the spurt of new technology, and thirdly, intensive rural development programmes. The first two programmes construe a package of measures and schemes to introduce land augmenting technological change in agriculture. The objective of this change is to raise yield and employment potentials of agriculture for accelerating the rate of growth in production and income. The third one includes number of measures to develop rural areas based on cluster approach or growth centre theory or multi-level planning system. Among them, the programmes to diversify agriculture and its allied activities are worth-noting. This is the third stage of modernisation through which Indian agriculture is assumed to be passing. The success of this stage depends on the extent to which the first two programmes have brought about a change in the technical form of production and in the structure of production relations in agriculture. These programmes brought about a fairly significant increase in agricultural yield, but not before early seventies and since the effectiveness of the measures to develop rural areas based on cluster

approach theory, depends on the success of the programmes to raise yield and employment potentials of agriculture for accelerating the growth in production and income, there would always be a time lag between agricultural growth and occupational diversification to take place.

In India, from 1950's onwards, the share of agriculture in national output fell consistently, and the share of non-farm sector rose (see Table 4.5). However, the employment structure response lagged about 25 years behind, it now appears. Instead of falling, the share of agriculture in the work force actually increased between 1961 and 1971. Thus there was retrogression in the Indian occupational structure, at least up until somewhere in the mid 70's.²¹ That is why our model does not render adequate explanation of the effect of independent variables on occupational diversification for the sub period 1961-71 while for the sub period 1971 to 1981 we find fairly high explanation and a close and positive association of proportion

²¹ Bhalla Sheila; Work-force Structure 1981 : Turning of the Tide, Paper presented for discussion at a seminar "On Development and Inter-Regional Disparities in India" held on March 19- 21, 1983, at GIDS, Lucknow, and published in Mishra, G.P., and Joshi, A. (Edit.) : Regional Structure of Development and Growth in India, Vol.I, Ashish Publishing House, New Delhi, 1983.

of agricultural income per worker, area under commercial crops and proportion of non-agricultural income with occupational diversification.

Thus our regression model gives a fairly high explanation and establishes a positive association between growth and occupational diversification in agriculture and its allied activities in Uttar Pradesh. There has been, at last, some change in the right direction after mid-seventies. In this context, we are prepared to argue that on the employment front, the most exciting thing that has happened in the past 50 years in U.P. is the 0.59 per cent decline in the share of male agricultural workers in total male workers in the State recorded by 1981 Census.²² Table 4.6 gives a bird's eye view of the shifts over the past two decades. This proportionate decline though marginal, which at last brings the direction of the trend in the employment structure into line with that of the output structure, may have many positive implications for the sake of people who remain in agriculture, and for the economy as a whole.

²²Ibid, p.163

Although the regression model gives a fairly high explanation of variation in agricultural work-force but the decline in agricultural workers is very nominal one, irrespective of the fact that it happened for the first time in last 50 years, and we can not say on this basis, that occupational diversification has taken place in Uttar Pradesh.

Before getting into details, it would be in fitness of the thing to have an overall view of the output and employment structure in the economy of Uttar Pradesh.

As is evident from Table 4.5, the share of agriculture in State income fell consistently, and the share of manufacturing and services rose. However, the employment structure response lagged far behind about 25 years. We can speculate that, like the high rate of savings observed during 1970's, despite low per capita incomes, the recent occupational shift may be in past, the end product of unequal income distribution. The income elasticity of demand for manufactured goods and services is highest for people in middle income and highest income groups respectively. Given a significant subset of the population moving upwards within these two

income categories the derived demand for labour in secondary and tertiary sector occupations may have risen considerably during the 1970's, even though the vast majority of population continued to eke out an existence at or below poverty line. In rural areas specifically the distribution of the gains from the new technology may be operating to produce such effects, and in the same regions, a fall in the elasticity of employment with the increasing use of modern inputs in the technology package.²³ However, to establish whether or not this shift constitute a healthy trend and indicate occupation diversification, a great deal of further work is required.

Though the State achieved spectacular growth in agricultural production and not only achieved the self sufficiency in foodgrains production but also created the surplus in agriculture and simultaneously the share of agriculture sector in State income declined. Why the occupational diversification is not taking place in agriculture and its allied activities. No doubt, State performed well on the front of agricultural production but failed miserably in mobilising the surplus created

²³Ibid, p.163

in agriculture to broaden and diversify the infrastructure so that it could offer more employment opportunities in non-agricultural sector and release the surplus labour from agriculture. The process of development in India in general and in Uttar Pradesh in particular has been accompanied by persistence of demand supply constraints on its development. The demand constraint denotes the lack of effective demand while the supply constraint owes its existence to sluggishness in the rate of capital growth.

It is well known fact that growing income inequalities in agriculture put a limit on the creation of demand for industrial goods and consequently, on the utilisation of industrial capacity. There also exist supply constraints because the generation of agricultural surplus (i.e. marketable) is not only sufficient condition for development but also the existence of some mechanism and motive to capitalise it.²⁴

²⁴Chakravorty, S; On the Question of Home Market and Prospects for Indian Growth, Economic and Political Weekly, Special Number, 1979, Bombay.

In fact the process of inter-exchange of surplus between agriculture and non-agriculture sector depends on the form or development of home market which is conditioned by the social division of labour and social relations between labour and capital as a means of production. In State agriculture there are many peasants who are not separated from the means of production and also hire out labour for subsistence consumption and as a result they enter the product market not voluntarily but involuntarily. In this case, the surplus accrues to the money lenders or traders.²⁵ Amit Dhaduri (1985) calls it forced commercialisation. Thus under the condition of forced commercialisation the marketed surplus does not lead to capital as such but to interest bearing or merchant capital while the 'distress sale' by the peasants does not create the demand for non-agricultural goods because that sale is compulsarily done for meeting consumption loans and other obligations. It is obvious that such forced commercialisation is linked with inter-locking of markets for product, credit,

²⁵ Mishra, G.P, et al, Estimation of Marketable Surplus of Foodgrains in U.P. 1966-67 to 1983-84, Mimeo, GIDS, Lucknow.

and land. If these markets are differentially specialised and separate which is possible only by separating completely the labour as a commodity and means of production, then 'normal commercialisation' would take place. Under the conditions of normal commercialisation the generation of supply will be for 'gains from trade' and capital formation will take place.²⁶

²⁶ Bhaduri, Amit; Class Relations and Commercialisation in Indian Agriculture : A Study in Post-Independence Agrarian Reforms in Uttar Pradesh, printed in Essays on the Commercialisation of Indian Agriculture, edited by KN Raj, Neeladari Bhattacharya, Sumit Guha and Sakti Gandhi, Oxford University Press, Delhi.

Table 4.1 : Modernisation and Growth : Regression Results,

Phase I : U.P. State

1956-57 to 1965-66

Crop	Constant			Tubewell Agricultural Ma- chinery	Fertili- ser con- sumption	Cropping Intensity	Area Irriga- ted	R ²	F Value
	0	1	2	3	4	5	6	7	8
Paddy		-7.286 (1.554)	0.034 (0.583)	1.445 (0.258)	-0.029 (0.595)	0.066 (1.714)	-0.067 (0.974)	0.609	1.244
Wheat		3.336 (0.549)	0.119 (3.366)**	-15.126 (2.129)	0.084 (1.206)	-0.002 (0.045)	0.058 (2.794)	0.807	3.337
Maize		4.583 (0.295)	-0.058 (0.551)	8.733 (0.636)	-0.017 (0.114)	-0.047 (0.425)	0.075 (0.648)	0.257	0.277
Total Foodgrains		3.096 (2.007)	-0.003 (0.780)	-0.045 (0.227)	-0.003 (0.174)	-0.033 (2.146)*	0.037 (2.638)*	0.836	4.088
Sugarcane		-485.750 (0.886)	2.526 (1.108)	-606.75 (0.652)	1.287 (0.365)	5.556 (0.889)	-2.710 (0.755)	0.637	1.402
Oilseeds		1.694 (0.390)	0.015 (0.504)	-1.683 (0.438)	0.056 (1.370)	-0.005 (0.151)	-0.022 (0.686)	0.668	1.606

Contd..../-

Table 4.1 Contd/-

Phase II : U. P. State 1966-67 to 1980-81

0	1	2	3	4	5	6	7	8
Paddy	1.792 (0.288)	0.0002 (0.013)	-0.071 (0.654)	0.009 (0.626)	0.018 (0.384)	0.007 (0.171)	0.376	1.085
Wheat	-4.978 (0.702)	-0.220 (0.614)	-0.123 (1.080)	0.020 (1.224)	0.042 (0.794)	0.016 (0.688)	0.486	1.702
Maize	-1.417 (0.345)	-0.015 (0.693)	-0.067 (0.843)	0.002 (0.146)	0.014 (0.437)	0.023 (0.648)	0.165	0.355
Total Foodgrains	-1.870 (0.682)	-0.006 (0.418)	-0.076 (1.433)	0.010 (1.275)	0.018 (0.843)	0.013 (0.561)	0.650	3.346
Sugarcane	-475.711 (1.731)	0.039 (0.055)	-8.290 (1.800)	-0.751 (1.006)	2.297 (1.270)	3.326 (2.573)**	0.530	2.030
Oil Seeds	-0.359 (0.178)	-0.005 (0.528)	0.018 (0.464)	-0.007 (1.300)	0.006 (0.375)	0.011 (0.636)	0.366	1.037

Contd..../-

Table 4.1 Contd/-

Phase III : U. P. State

1966-67 to 1980-81

	Constant	Area irrigated by Tubewell	Agricul- tural machinery	Area under HYV	Fertili- ser con- sumption	Cropping inten- sity	Area irriga- ted	R ²	F Value
Paddy	-7.472 (3.734)	-0.061 (7.457) ***	0.142 (4.166) ***	0.054 (9.356) ***	0.008 (1.688)	0.070 (4.629) **	0.005 (0.370)	0.947	24.211***
Wheat	-5.730 (0.885)	-0.044 (1.108)	-0.174 (1.450)	0.016 (0.675)	0.015 (0.935)	0.044 (0.855)	0.053 (1.039)	0.550	1.632
Maize	0.347 (0.078)	0.003 (0.127)	-0.045 (0.548)	-0.017 (1.038)	0.002 (0.188)	-0.003 (0.087)	0.025 (0.713)	0.264	0.478
Total Foodgrains	-4.476 (2.196)	-0.033 (2.296)	-0.109 (2.081)	-0.025 (3.334) **	0.009 (1.722)	0.042 (2.623) **	0.010 (0.612)	0.854	7.770***
Sugarcane	-478.469 (1.628)	-0.034 (0.026)	-8.364 (1.850)	0.067 (0.070)	-0.742 (0.923)	2.342 (1.154)	3.293 (2.273) *	0.530	1.503
Oil Seeds	-1.780 (0.934)	-0.020 (1.706)	0.0002 (0.008)	0.013 (1.945) *	-0.008 (1.561)	0.019 (1.274)	0.009 (0.607)	0.569	1.759

Note : (i) t values are given in brackets

(ii) * significant at 10 per cent

** significant at 5 per cent

*** significant at 1 per cent.

Table 4.2 : Modernisation and Growth Regression Results.

Eastern Region

1956-57 to 1965-66

Crop	R ²							
	0	1	2	3	4	5	6	7
		Constant	Area irrigated by Tubewells	Agricul- tural Machinery	Fertiliser consumption	Cropping intensity	Area irrigated	F Value
Paddy		-2.201 (0.666)	0.056 (0.865)	1.661 (0.209)	-0.005 (0.113)	0.025 (0.914)	-0.170 (0.890)	0.592 1.161
Wheat		30.926 (0.207)	0.594 (0.538)	267.180 (1.150)	-2.476 (2.182) *	-0.219 (0.243)	-0.206 (0.317)	0.664 1.584
Maize		11.930 (1.426)	0.067 (1.047)	-4.082 (0.365)	-0.012 (0.165)	-0.054 (1.056)	-0.123 (1.485)	0.425 0.592
Total Foodgrains		-0.871 (0.311)	0.017 (0.773)	2.437 (0.651)	-0.027 (1.063)	0.010 (0.605)	0.000 (0.003)	0.671 1.629
Sugarcane		49.938 (0.172)	2.347 (1.624)	-380.313 (0.675)	0.674 (0.222)	0.955 (0.607)	-2.077 (0.647)	0.753 2.434
Oil Seeds		-1.841 (0.499)	-0.010 (0.346)	-5.040 (1.022)	0.039 (1.167)	0.022 (0.955)	-0.013 (0.343)	0.466 0.697

Contd...../-

Table 4.2 (Contd....)

Phase II : Eastern Region

1966-67 to 1980-81

0	1	2	3	4	5	6	7	8
Paddy	1.277 (0.539)	-0.008 (0.867)	0.088 (1.026)	0.021 (2.397) **	-0.0003 (0.018)	-0.104 (-3.069) **	0.663	3.541**
Wheat	3.354 (1.215)	0.002 (0.250)	-0.039 (0.618)	0.014 (2.003) *	-0.013 (0.708)	-0.012 (1.483)	0.775	6.196***
Maize	6.803 (1.406)	-0.045 (1.618)	0.108 (0.795)	0.026 (1.768)	-0.058 (1.082)	0.061 (0.628)	0.359	0.998
Total Foodgrains	4.484 (1.266)	-0.018 (0.899)	-0.079 (0.793)	0.020 (1.895) *	-0.048 (1.208)	0.072 (1.018)	0.529	2.025
Sugarcane	106.328 (1.251)	0.278 (1.027)	-2.389 (1.100)	0.608 (2.290) **	-0.299 (0.585)	-0.429 (0.621)	0.468	1.583
Oil Seeds	-0.134 (0.115)	-0.0001 (0.008)	-0.001 (0.028)	-0.002 (0.480)	0.004 (0.278)	0.001 (0.035)	0.074	0.144

Contd..../-

Table 4.2 (Contd....)

Phase II : Eastern Region1966-67 to 1980-81

0	1	2	3	4	5	6	7	8
Paddy	1.277 (0.539)	-0.008 (0.867)	0.088 (1.026)	0.021 (2.397) **	-0.0003 (0.018)	-0.104 (-3.069) **	0.663	3.541**
Wheat	3.354 (1.215)	0.002 (0.250)	-0.039 (0.618)	0.014 (2.003) *	-0.013 (0.708)	-0.012 (1.483)	0.775	6.196***
Maize	6.803 (1.406)	-0.045 (1.618)	0.108 (0.795)	0.026 (1.768)	-0.058 (1.082)	0.061 (0.628)	0.359	0.998
Total Foodgrains	4.484 (1.266)	-0.018 (0.899)	-0.079 (0.793)	0.020 (1.895) *	-0.048 (1.208)	0.072 (1.018)	0.529	2.025
Sugarcane	106.328 (1.251)	0.278 (1.027)	-2.389 (1.100)	0.608 (2.290) **	-0.299 (0.585)	-0.429 (0.621)	0.468	1.583
Oil Seeds	-0.134 (0.115)	-0.0001 (0.008)	-0.001 (0.028)	-0.002 (0.480)	0.004 (0.278)	0.001 (0.035)	0.074	0.144

Contd..../-

Table 4.2 (Contd....)

Phase III : Eastern Region1966-67 to 1980-81

0	1	2	3	4	5	6	7	8	9
Paddy	-1.968 (0.914)	-0.020 (2.364) **	-0.020 (0.261)	0.021 (2.753) **	0.011 (1.452)	0.024 (1.477)	-0.064 (2.173) *	0.827	6.371*
Wheat	2.220 (0.778)	-0.004 (0.358)	-0.063 (0.965)	0.009 (1.203)	0.011 (1.621)	-0.004 (0.198)	-0.012 (1.513)	0.809	5.657*
Maize	9.149 (1.477)	-0.045 (1.559)	0.126 (0.882)	-0.011 (0.643)	0.030 (1.821)	-0.085 (1.222)	0.093 (0.832)	0.389	0.848
Tool Foodgrains	0.373 (0.094)	-0.019 (1.014)	-0.111 (1.215)	0.020 (1.769)	0.012 (1.163)	-0.001 (0.015)	0.015 (0.214)	0.661	2.605
Sugarcane	102.578 (1.139)	-0.344 (1.023)	-2.782 (1.104)	0.105 (0.369)	0.604 (2.160) *	-0.196 (0.323)	-0.558 (0.691)	0.477	1.215
Oil seeds	-2.284 (2.812)	-0.002 (0.053)	-0.018 (0.941)	0.010 (4.492) ***	-0.006 (2.669) **	0.028 (3.087) **	-0.029 (1.966) *	0.738	3.747*

Contd..../-

Table 4.2 (Contd....)

Phase I : Western Region1956-57 to 1965-66

0	1	2	3	4	5	6	7	8
Paddy	-2.377 (0.452)	0.005 (0.522)	-0.299 (0.161)	-0.008 (0.205)	-0.031 (0.781)	-0.035 (2.121)	0.745	2.333
Wheat	6.462 (0.579)	0.022 (1.247)	-0.952 (0.311)	0.103 (0.929)	-0.036 (0.447)	-0.030 (0.944)	0.475	0.725
Maize	120.679 (0.739)	-0.124 (0.485)	72.552 (0.278)	3.289 (2.090)	-0.669 (0.573)	-1.101 (1.553)	0.631	1.370
Total Foodgrains	16.345 (1.419)	0.007 (0.383)	3.895 (1.222)	0.024 (0.218)	-0.120 (1.462)	-0.022 (0.449)	0.534	0.916
Sugarcane	155.938 (0.566)	0.696 (0.776)	62.672 (0.488)	0.886 (0.403)	-0.882 (0.424)	-0.427 (0.197)	0.650	1.484
Oil Seeds	8.809 (1.700)	0.003 (0.390)	1.110 (0.774)	0.066 (1.314)	-0.061 (1.646)	-0.019 (0.862)	0.726	2.115

Contd..../-

Table 4.2 (Contd....)

Phase II : Western Region

1966-67 to 1980-81

0	1	2	3	4	5	6	7	8
Paddy	0.070 (0.036)	0.007 (0.834)	-0.009 (0.130)	0.014 (2.544) **	0.009 (0.639)	-0.028 (1.469)	0.844	9.768***
Wheat	-2.172 (0.885)	-0.007 (0.543)	-0.018 (1.522)	0.016 (2.310) **	0.024 (1.354)	0.006 (0.550)	0.746	0.864
Maize	76.962 (2.717)	0.003 (0.098)	-0.675 (3.162) **	-0.002 (0.125)	0.127 (2.778) **	0.025 (1.170)	0.561	2.298
Foodgrains	1.098 (0.866)	0.014 (2.056) *	-0.101 (1.840)	0.010 (2.727) **	0.015 (1.610)	-0.009 (1.138)	0.873	12.385***
Sugarcane	5.621 (0.103)	0.358 (1.550)	-3.014 (1.676)	0.111 (0.711)	0.053 (0.125)	0.216 (0.421)	0.520	0.724
Oil Seeds	-1.041 (0.713)	-0.001 (0.094)	-0.009 (0.182)	-0.007 (1.683)	0.012 (1.141)	0.003 (0.691)	0.379	1.098

Contd..../-

Table 4.2 (Contd....)

Phase III : Western Region

1966-67 to 1980-81

0	1	2	3	4	5	6	7	8	9
Paddy	-2.479 (0.937)	0.018 (1.396)	-0.114 (1.173)	-0.004 (0.348)	-0.005 (0.602)	0.007 (0.382)	0.053* (2.160)	0.885	4.799**
Wheat	-2.217 (0.880)	-0.025 (0.896)	-0.145 (1.651)	0.014 (0.730)	0.013 (2.348)**	0.027 (1.455)	0.006 (0.577)	0.762	4.260**
Maize	-16.501 (2.881)	0.101 (1.523)	-0.516 (2.363)**	-0.078 (1.649)	-0.016 (0.875)	0.108 (2.488)**	0.019 (0.978)	0.672	2.732
Total Foodgrains	-1.209 (1.124)	-0.010 (0.815)	-0.140 (1.416)	0.019 (2.126)**	0.013 (3.933)***	0.019 (2.392)**	0.008 (2.124)*	0.919	15.112***
Sugarcane	12.113 (0.226)	-0.299 (0.511)	-3.994 (2.071)*	0.561 (1.217)	0.220 (1.247)	0.241 (0.548)	-0.005 (0.010)	0.599	1.989
Oil Seeds	-2.284 (2.812)	-0.002 (0.053)	-0.018 (0.941)	0.010 (4.492)***	-0.006 (2.665)**	0.028 (3.087)**	-0.029 (1.966)*	0.738	3.753**

Note : (i) t values are given in brackets

(ii) * significant at 10 per cent

** significant at 5 per cent

*** significant at 1 per cent.

Table 4.3 : Modernisation and Growth Regressing Results.

Phase I : Gorakhpur

1956-57 to 1965-66

Crop	Constant	Area irri- gated by Tubewells	Agricul- tural Machinery	Fertili- ser con- sumption	Cropping inten- sity	Area irri- gated	R ²	F Value
Paddy	1.366 (1.383)	0.002 (0.114)	-13.895 (1.028)	0.042 (0.838)	0.001 (0.228)	0.705 (1.260)	0.834	4.021
Wheat	2.485 (1.797)	0.074 (2.390)*	7.856 (0.463)	-0.030 (0.640)	0.010 (1.820)	-0.020 (0.870)	0.818	0.904
Maize	6.396 (0.947)	0.082 (1.011)	-5.142 (0.115)	-0.023 (0.130)	0.016 (0.936)	-0.213 (0.976)	0.381	0.643
Total Food- grains	0.619 (0.513)	0.007 (0.503)	-14.630 (1.828)	-0.032 (1.008)	-0.002 (0.811)	0.044 (1.126)	0.894	6.776
Sugarcane	-11.541 (0.116)	1.674 (0.806)	918.188 (0.477)	4.624 (0.910)	-0.507 (0.899)	0.175 (0.091)	0.619	1.300
Oil Seeds	-2.477 (1.236)	-0.011 (0.465)	-0.127 (0.010)	-0.043 (0.813)	-0.003 (0.517)	0.091 (1.409)	0.406	0.546

Contd..../-

Table 4.3 (Contd....)

Phase II : Gorakhpur1966-67 to 1980-81

0	1	2	3	4	5	6	7	8
Paddy	-3.967 (2.473)	-0.003 (0.259)	-0.080 (1.209)	0.003 (0.395)	0.036 (2.915)**	0.015 (0.071)	0.659	3.477**
Wheat	1.165 (1.200)	-0.001 (0.162)	-0.016 (0.407)	0.010 (2.737)**	0.019 (2.351)**	-0.032 (1.346)	0.805	7.452***
Maize	11.121 (3.713)	-0.042 (3.627)**	0.119 (1.390)	0.018 (2.177)*	-0.090 (3.004)**	0.054 (1.752)	0.748	5.349**
Total Foodgrains	-0.461 (0.451)	-0.006 (1.494)	-0.036 (1.220)	0.005 (1.938)*	0.006 (0.597)	0.014 (1.296)	0.845	9.785***
Sugarcane	102-316 (2.079)	-0.217 (0.990)	-2.821 (1.467)	0.539 (2.632)**	-0.508 (1.454)	0.143 (0.262)	0.586	2.549
Oil Seeds	0.141 (0.087)	0.006 (0.912)	-0.017 (0.376)	-0.005 (1.248)	0.003 (0.199)	-0.001 (0.055)	0.227	0.529

Contd..../-

Table 4.3 (Contd....)

Phase III : Gorakhpur

1966-67 to 1980-81

	Constant	Area irri- gated by Tubewells	Agricul- tural Machine- ry	Area under HYV	Fertili- ser con- sumption	Cropping intensity	Area irri- gated	R ²	F Value
0	1	2	3	4	5	6	7	8	9
Paddy	-2.989 (1.602)	-0.004 (0.442)	-0.093 (1.390)	0.006 (1.021)	0.002 (0.250)	0.029 (1.997) *	0.014 (0.251)	0.698	3.084
Wheat	-1.560 (1.166)	-0.003 (0.592)	0.033 (0.673)	-0.008 (1.807)	0.008 (2.005) *	0.009 (0.862)	0.020 (1.601)	0.782	4.788**
Maize	10.800 (3.346)	-0.041 (3.213) **	0.115 (1.266)	0.005 (0.434)	0.016 (1.838)	-0.083 (2.371) **	0.038 (0.797)	0.754	4.087**
Total Foodgrains	-0.645 (0.598)	-0.005 (1.202)	-0.038 (1.266)	0.003 (0.737)	0.005 (1.565)	0.010 (0.850)	0.005 (0.299)	0.854	7.830***
Sugarcane	87.684 (1.584)	-0.183 (0.787)	-2.473 (1.204)	-0.113 (0.666)	0.579 (2.634) **	-0.340 (0.772)	0.021 (0.035)	0.608	2.067
Oil Seeds	-0.743 (0.661)	0.010 (2.224) *	-0.030 (0.950)	0.013 (3.419) ***	-0.009 (2.817) **	0.022 (1.789)	-0.043 (2.594) **	0.686	2.913

Contd..../-

Table 4.3 (Contd....)

Phase I : Muzaffarnagar1956-57 to 1980-81

0	1	2	3	4	5	6	7	8
Paddy	-2.917 (1.714)	-0.001 (0.262)	-0.152 (0.707)	-0.015 (0.629)	0.034 (2.488)*	-0.009 (0.523)	0.651	1.493
Wheat	5.023 (1.281)	-0.001 (0.166)	-0.320 (0.739)	0.007 (0.162)	-0.046 (0.985)	0.040 (0.733)	0.622	1.314
Maize	-3.761 (0.504)	-0.006 (0.359)	0.489 (0.514)	0.019 (0.207)	0.030 (0.409)	0.003 (0.039)	0.245	0.260
Total Food- grains	3.096 (2.008)	-0.003 (0.780)	-0.045 (0.227)	-0.003 (0.174)	-0.033 (2.046)	0.037 (2.638)*	0.836	4.088
Sugarcane	-183.156 (0.648)	0.197 (0.508)	-12.469 (0.704)	0.673 (0.319)	-0.021 (0.018)	2.643 (0.864)	0.531	0.907
Oil Seeds	- 0.369 (0.261)	-0.001 (0.375)	0.097 (0.537)	-0.012 (0.707)	-0.007 (0.466)	0.027 (2.039)	0.638	1.412

Contd..../-

Table 4.3 (Contd....)

Phase II : Muzaffarnagar

1966-67 to 1980-81

0	1	2	3	4	5	6	7	8
Paddy	-0.791 (0.614)	0.006 (0.414)	-0.004 (0.145)	0.005 (0.984)	0.024 (2.572)**	-0.028 (1.261)	0.871	12.178***
Wheat	-7.557 (2.007)	-0.019 (0.774)	-0.031 (0.792)	0.003 (0.331)	0.035 (1.988)*	0.056 (1.643)	0.733	4.939**
Maize	0.264 (0.063)	0.047 (1.570)	-0.071 (1.775)	-0.012 (1.247)	-0.012 (0.662)	0.015 (0.316)	0.402	1.211
Total Food- grains	-1.212 (0.373)	0.005 (0.231)	-0.006 (0.203)	0.011 (1.460)	0.017 (1.256)	-0.008 (0.221)	0.797	7.052***
Sugarcane	129.625 (1.554)	0.416 (0.862)	-0.501 (0.631)	0.074 (0.358)	-0.565 (1.488)	-0.184 (0.306)	0.260	0.633
Oil Seeds	2.157 (1.551)	0.008 (0.756)	0.019 (1.416)	-0.004 (1.190)	-0.015 (1.522)	0.005 (0.279)	0.622	2.965

Contd..../-

Table 4.3 (Contd....)

Phase III : Muzaffarnagar

1966-67 to 1980-81

0	1	2	3	4	5	6	7	8	9
Paddy	-3.749 (2.385)	-0.047 (1.525)	0.022 (0.818)	0.023 (2.369)**	0.009 (1.807)	0.034 (3.246)**	0.011 (0.673)	0.892	11.031***
Wheat	-6.335 (1.368)	-0.005 (0.125)	-0.024 (0.560)	-0.010 (0.499)	0.004 (0.348)	0.025 (0.870)	0.056 (1.560)	0.741	3.813**
Maize	1.358 (0.178)	0.057 (0.905)	-0.067 (1.342)	-0.005 (0.177)	-0.011 (1.063)	-0.017 (0.467)	0.008 (0.120)	0.404	0.903
Total Foodgrains	5.141 (0.982)	0.061 (1.412)	0.020 (0.589)	-0.029 (1.494)	0.014 (1.946)*	-0.016 (0.622)	-0.051 (1.125)	0.841	7.048***
Sugarcane	187.328 (1.960)	1.063 (1.458)	-0.191 (0.233)	-0.488 (1.166)	0.092 (0.454)	-1.053 (1.880)*	-0.222 (0.374)	0.368	0.777
Oil Seeds	2.418 (0.930)	0.010 (0.468)	0.020 (1.206)	-0.001 (0.122)	-0.004 (1.028)	-0.006 (1.299)	0.003 (0.127)	0.623	2.200

Note : (i) t values are given in brackets

(ii)

* significant at 10 per cent

** significant at 5 per cent

*** significant at 1 per cent

Table 4.4 : Growth and Occupational Diversification : Regression Results
U. P. State.

Period	Constant	Agricultural income per X_1 worker	Area under X_2 Commer- cial Crops	Production of Non-agricultu- ral income to total income X_3	R^2	F Value
1960-61 to 1970-71	31.453 (1.462)	0.017 (1.814)	-0.63 (0.432)	0.956 (2.384)*	0.626	3.354
1970-71 to 1980-81	94.695 (92.320)	-0.002 (6.746)***	-0.205 (2.48)**	-0.103 (8.751)***	0.927	29.458***

Note : (1) t values are given in brackets.

(11)

* significant at 10 per cent.

** significant at 5 per cent.

*** significant at 1 per cent.

Table 4.5 : Sector-wise Percentage Distribution of
State Income in Uttar Pradesh
(at 1970-71 prices)

Sectors	1960-61	1964-65	1970-71	1975-76	1980-81
1. Agriculture & Allied Sectors	65.59	62.19	60.00	58.40	54.40
2. Mining, Manufactu- ring and Construc- tion	10.52	13.77	14.60	14.80	17.60
3. Electricity, gas, water supply, transport, storage and communications	12.78	12.59	13.50	14.30	15.30
4. Services	11.11	11.45	11.90	12.50	12.70
TOTAL	100.00	100.00	100.00	100.00	100.00

Note : Since 1965-66 was a drought year and does not depict the true picture, we have replaced it with 1964-65.

Source: State Income Estimates, Directorate of Economics and Statistics, U.P., Lucknow.

Table 4.6 : Share of Male Cultivators, Agricultural Labourers and Non-agricultural Workers in Total Male Workers in U.P. (Percentage)

Years	Cultivators		Agricultural labourers		Total Agricultural Workers		Non-Agricultural Workers	
	Share in share	Change in share	Share in share	Change in share	Share in share	Change in share	Share in share	Change in share
1961	71.65		10.14		81.79		18.21	
1971	67.28	-4.37	19.20	19.06	86.48	+4.69	13.52	-4.69
1981	70.06	+2.78	15.83	-3.37	85.89	-0.59	14.11	+0.59

Note : Calculations based on Data derived from Census of India, (U.P.), 1961, 1971 and 1981.

CHAPTER V

Production Relations in U. P. Agriculture

The purpose of this chapter is to examine production relations in agriculture. It is taken into consideration because agricultural growth is not only a function of modernisation or introduction of new productive forces but also subject to the farmer's responsiveness to modernise agriculture or adopt them in the process of farm production. In other words, the prevailing or existing production relations matter in the operationalisation of modernisation and so in the performance of agricultural growth. Hence the case of production relations in agriculture is examined in the context of ^{districts} Auzaffarnagar and Gorakhpur/belonging to the Western and Eastern regions of the State respectively. Data involved in analysing the production relations in the context of these two districts are taken from the Planning Commission sponsored project.

Output, Wages and Employment in U.P.'s Agriculture and the reference year is 1980-81.

Production Relations-Concept and Studies

Production relations can be defined in terms of social relations among people in the process of the production, distribution, exchange and consumption of

material wealth. They are the social form of production through which people appropriate the objects of nature. The production relations, in their unity with the productive forces, form a historically defined mode of production. The totality of the production relations constitutes the economic structure of the society which provides the base for a legal and political superstructure.

Marx¹ (1977) wrote : "In the social production of their existence, men inevitably enter into definite relations, which are independent of their will, namely relations of production appropriate to a given stage in the development of their material forces of production. The totality of these relations of production constitutes the economic structure of society, the real foundation, on which arises a legal and political superstructure and to which correspond definite forms of social consciousness".

¹Marx, K., "A Contribution to the Critique of Political Economy", Progress Publishers (Moscow), 1977.

There has been a great debate since 1970 both in the academic and policy making circles about the existing mode of production in Indian agriculture. There have been the proponents of capitalism, pre-capitalism, semi-feudalism, colonial and post-colonial modes and recently, a dual mode. Authors of important contribution to this debate include economists; Ashok Rudra² (1978), Utsa Patnaik³ (1971-72), G.P. Mishra⁴ (1982), Amit Bhaduri⁵ (1973), Deepak Gupta⁶ (1980), Ranjit Sau⁷ (1973), Pradhan H. Prasad⁸

²Rudra, Ashok, Class Relations in Indian Agriculture, Economic and Political Weekly, June 3, 10 and 17, 1978.

³Patnaik, Utsa, Capitalist Development in Agriculture, EPW, Sept. 21, 1971; Capitalist Development in Agriculture Further Comment, EPW, December, 1971; On the Mode of Production in Indian Agriculture : A Reply, EPW, Sept. 1972; Development of Capitalism in Agriculture, Social Scientist, Sept. & Oct., 1972.

⁴Mishra, G.P., Dynamics of Village Development in Rural India, Ashish Publishing House, New Delhi, 1982.

⁵Bhaduri, Amit, An Analysis of Semi-Feudalism in East Indian Agriculture, Frontier, Sept. 29, 1973.

⁶Gupta, D., Formal and Real Subsumption of Labour Under Capital : The Instance of Share Cropping, EPW, XV (1980), 39, Review of Agriculture, 98, 106.

⁷Sau, Ranjit, On the Essential and Manifestation of Capitalism in Indian Agriculture, EPW, March, 1973.

⁸Prasad, Pradhan, H, Production Relations : A Chilles Meel of Indian Planning, EPW, May 12, 1973.

(1973), Paresh Chattopadhyay⁹ (1972), Sharat G. Lin¹⁰ (1980), John Harris¹¹ (1982), and Joan Mencher¹² (1978). Sociologist Hamza Alvi¹³ (1975), Gail Omvedt¹⁴ (1981) and Alice Thorner¹⁵ (1982).

The successive formulations, presentations of data, critiques and rejoinders have appeared mostly in the 'Economic and Political Weekly', 'Frontier', and 'Social Scientist' are the two other journals which have published substantial contributions. Although

⁹Chattopadhyay, Paresh, On the Question of Mode of Production in Indian Agriculture, EPW, March, 1972.

¹⁰Lin, Sharat, G, Theory of Dual Mode of Production in Post-Colonial India, in Two Parts, EPW, XV (1980), 10 and 11, 516-529, 565, 578.

¹¹Harris, John, Capitalism and Peasant Farming, Oxford University Press, 1982.

¹²Mencher, Joan, Agriculture and Social Structure in Tamil Nadu, Allied Publishers (Delhi), 1978.

¹³Alvi, Hamza, India and the Colonial Mode of Production, EPW, Special Number, August, 1975.

¹⁴Omvedt, Gail, Capitalist Agriculture and Rural Classes in India, EPW, December, 1981.

¹⁵Thorner, Alice, Semi Feudalism or Capitalism, Contemporary Debate on Classes and Modes of Production in India, EPW, 4, 11 and 18 December, 1982.

the cut and thrust of the argument has been carried exculsively in the periodicals, a handful of books have been published in India and abroad during the period.

Since 1970, the debate has been carried on simultaneously at several levels; that of the individual cultivating unit, agricultural sector of a particular region or of India as a whole, that of entire economy of a region or of India as a whole.

In the course of about past two decades of the debate it can be said without least reservation that capitalism (thereby capitalist mode of production) to-day dominates the Indian agriculture. But before arriving at a particular conclusion about the prevalence of capitalism in Indian agriculture, one should be clear about what does the term capitalist mode of production imply?

The capitalist mode of production refers to a social mode of production of material production based on private capitalist ownership of the means of production and the exploitation of wage labour. Marx,

about capitalism, wrote : "a social mode of production under which the process of production is subordinated to capital, i.e. which is founded on the relationship between capital and hired labour".

The main economic law of the capitalist mode of production is the creation of surplus value by the workers and its appropriation by the capitalists. The source of surplus value is the unpaid labour of wage workers. Similarly, the capitalist relations of production imply the methods of surplus appropriation consequent upon the advent of generalised commodity production. The generalised commodity production occurs when every factor of production behave as commodity with a price. And for the sake of its reproduction capital has to be reinvested.

It has been abundantly shown that neither the existence of wide-spread tenancy and/or share-cropping nor the concentration of land-holding together with cultivation of small units by large number of peasants necessarily indicate the presence of feudal relations of production in Indian agriculture. At the same time

the use of wage labour can not by itself be taken as a sure sign of capitalist relations. Yet the shift from exploitation through tenants to large scale or intensive farming by means of hired labour is significant.

The growth of capitalism in Indian agriculture has been accompanied by, a transformation of relations of production and forms of exploitation. The debt bounded or traditionally tied labour has almost been replaced by relatively mobile and free and wage labour is largely paid in cash. Investment in modern, scientific agriculture has enormously increased and has resulted in enhanced production of particular crops in certain regions. Tenancy and share-cropping arrangements have, in many regions, been adopted to the new economic and technical requirements.

Several authors (Pradhan H. Prasad¹⁶ etc.) who accept the prevalence of capitalism in Indian agriculture express grave doubts about its further and full development. They point out obstacles to further development of capitalism in Indian agriculture such as the relative narrow industrial base in terms of

¹⁶ Ibid, p. 190

the size of the country, dependence of its industry on foreign technology, limited scope of employment provided by the secondary sector and extremely low level of economic demand for consumer goods.

we
Here/agree with G.P. Mishra et.al.¹⁷(1982, p.64) when he opines that there may coexist feudal characteristics with capitalist relations. But.this does not mean the predominance of semi-feudalism over capitalism. Obviously Indian agriculture is not completely transformed into capitalistic one but is undergoing such transformation. In his own words :
"Transformation is a continuous historical process but transition is a passing phase in the process of transformation. This phase reflects how the introduction of new productive forces contradicts with the existing production relations. Such forces being new and external to the existing production relations face resistance so far as their operation by landlords is concerned. But the operational process of resistance does not continue for a long period of time. When the plough-back effects from the use of

¹⁷ Mishra, G.P., Rai, R.P. and Others, Village Industries and Agriculture in Changing Agrarian Situation, Ashish Publishing House, New Delhi, 1985.

new productive forces by some of them are realised, they start to diffuse over others in rural areas. Hence both, 'pull up' and 'pull down' forces operate there simultaneously. In some parts, the landlords living on usury and rent may not be inclined to use these forces and this may work as a 'pull down' force. As a result, the development of capitalism may be restricted there for some time. But as the strength of these forces has gathered momentum due to their reinforcement either deliberately or spontaneously in the economy, there may be an emergence of capitalist relations. Hence there may coexist feudal features, with capitalist relations. But this does not mean the predominance of semi-feudalism over capitalism. One may say that the rural society is not completely transformed into capitalistic one but is undergoing such transformation". Frederic C. Lane¹⁸ in his paper 'Meanings of Capitalism', (1969) wrote : "It is hard to find a society 100 per cent capitalist or 0 per cent capitalist".

¹⁸ Lane, F.C., Meaning of Capitalism, Journal of Social and Economic History, March, 1969.

To be more clear about the development of capitalism it is just proper to quote Lenin¹⁹ (1960, p.323).

"It is a great mistake to think that the inception of agricultural capitalism itself requires some special form of land tenure. "But the form of landed property with which the inceptient capitalist mode of production is confronted does not suit it. It first creates for itself the form required by subordinating agricultural capital. It thus transforms feudal landed property, small peasant property in mark communes - no matter how divergent their juristic forms may be - into the economic form corresponding to the requirements of this mode of production". Thus by the very nature of the case, no peculiarities in the system of land tenure can serve as an insurmountable obstacle to capitalism which assumes different forms in accordance with the different conditions in agriculture, legal relationships and the manner of the life".

The capitalism which emerged in rural India is not spatially uniform in its impact as Mishra et.al²⁰ (1985, p.57) aptly remarks:

¹⁹ Lenin, V.I., 1960a; The Development of Capitalism in Russia, In V.I. Lenin, Collected Works, Volume III, Moscow, Foreign Languages Publishing House.

²⁰ Ibid, p.195

Available evidence indicates the emergence of capitalism as a system moulding force in the socio-economic structure of production in rural India. But the spurt of this force has not been spatially uniform nor its influence in the socio-economic structure of production. As a result, the emergent new relations in production, i.e., capitalist, coexist alongwith some earlier production relations such as Asiatic or pre-capitalist.

The spatial variations in the emergence and development of capitalism as a system moulding force in the socio-economic structure of production - can be attributed to many factors such as existence of family labour based farms, growth of money capital, existence of household and village industries based on traditional technologies, lopsided land augmenting technological development in agriculture, the existence of a wide gap of technological development between agriculture and industry; and existence of semi-feudal elements in rural areas etc.

Production Relations in Agriculture

Like-wise, neither the growth of capitalism is spatially uniform in Western and Eastern regions of U.P. nor its impact on the socio-economic structure of production is the same. The reason behind this spatial variation is simple enough. The Eastern U.P. has been one of the neglected areas even before British rule. During British rule nearly all agricultural development took place in the Western region. The major development was the construction of network of canals which reduced the element of risk in agriculture and induced the farmers to experiment with new techniques and crops. Farmers in the Eastern part of U.P., with their high density of population, resulting in heavy pressure on land and complete dependence on natural forces for agriculture were not in a position to take risks or experiment in ways that, if they failed, can threaten their existence. Eastern U.P. agriculture being a very low paying business received low priority in both private and public investment allocations. Small and scattered land holdings coupled with traditional technology, made large scale investments

in agriculture both risky and uneconomic which led to capital starvation which depressed returns from agriculture.²¹

In the above setting we shall analyse the production relations in Muzaffarnagar and Gorakhpur districts of Uttar Pradesh. Four villages have been taken from each district. The characteristics of development in Muzaffarnagar and Gorakhpur districts manifest development of capitalism as a system moulding force in the socio-economic structure of production in agriculture. This force has led to the emergence of a class of peasants who use new capital inputs in farming, market a portion of their agricultural produce and have commercialised a part of farming for market production. In other words, these characteristics reflect that the peasantry attached to land and technical means of production is differentiable in sampled villages. But these characteristics are not enough for differentiating peasantry in terms of different classes.

Lenin²² has classified peasantry in terms of different classes on the basis of three coordinates of

²¹ Ibid, p. 195

²² Lenin, V.I., The Development of Capitalism in Russia, Progress Publishers, Moscow, 1977.

reference; family labour/wage labour, subsistence income/surplus income, and the size of land holdings. Here the first coordinate of reference in family labour/wage labour is taken for differentiating peasantry from one class to another in the context of districts Muzaffarnagar and Gorakhpur because the existence of wage labour assumes alienation of the owners of labour from the ownership of the means of production i.e. that kind of property which exploits wage labour and which cannot increase except upon condition of begetting a new supply of wage labour also implies the emergence of a group of entrepreneur who present the demand for the labour power of the rural proletariat. The coexistence of these two classes present an interdependence between the formulation of a class of rural entrepreneurs (i.e. peasant bourgeoisie) and the expansion of the bottom of the peasantry i.e. the increase in the number of rural proletarians. Moreover, the form of hiring labour on wages in agriculture is very peculiar and very characteristics of capitalist agriculture and this process characterises social relations existing between hirers and hired and then also reflect some kind of a commercial transaction for purchase and sale of labour power. The purchase and sale of

labour power by a peasant also define his relative class position in production.

By using the coordinate of reference family labour/wage labour or speaking more precisely hired in/hired out labour power reference the peasantry in the different villages of the both districts is divided into six classes.

1. $SE = 0, HI > 0, HO = 0$ Capitalist landlords
2. $SE > 0, HI > 0, HO = 0$ Capitalist peasants
3. $SE > 0, HI = 0, HO = 0$ Family or middle peasants
4. $SE > 0, HI = 0, HO > 0$ Poor peasants
5. $SE > 0, HI > 0, HO > 0$ small peasants
6. $SE = 0, HI = 0, HO > 0$ Landless agricultural labourers.

(Here SE denotes to self-employment, HI to hired-in labour and HO to hired out labour).

The first group stands for the class of capitalist landlords who do not employ their family labour but only hire in labour from others in agriculture. The second refers to rich/capitalist peasants who employ their family labour, hire in labour but do not hire out their family member in off farms. The third one is a class of family or middle peasants who simply employ their family labour

in agriculture but do not hire out or hire in labour. The fourth describes the class of poor peasants who do not hire in labour from others but only hire out their family labour in addition to their self-employment. The fifth category refers to the small peasants who either don't possess the land at all but cultivating leased in land or have very small land holding size and they not only hire out the family labour but hire in as well from others during peak farming season. Sixth and last category refers to the class of agricultural labourers who fully depend on hiring out their labour power in others farms. Hence the question of self-employment and hiring in labour does not arise because they don't own or operate a piece of land for cultivation.

In Muzaffarnagar district, the capitalist landlords and marginal farmers are completely absent as Table 5.1 indicates. All the other classes are observed in the district. The class distribution of agricultural households shows that 44.38 per cent of the total households, in fact, belong to capitalist peasant class followed by landless agricultural labour class (34.22 per cent). These two classes (i.e. capitalist and landless agricultural labour class) taken together constitute a major

chunk (78.70 per cent) of entire peasantry which coupled with the complete absence of capitalist landlords and poor peasants class, speaks of the prevalence of capitalist production relations in agricultural sector of the district. Another noteworthy conclusion which emerges is that majority of the households belonging to capitalist peasant class are from small, medium and marginal holding sized groups of land in the district while large holding sized group of farmers account only for a little over 4 per cent of the total households belonging to capitalist class. The poor peasants as a class belong to the marginal farm size group and is not significant being 5.32 per cent only of the total households. A majority of farmers in family peasant or middle class operate marginal holdings (9.47 per cent) and small holdings (5.33 per cent). Thus the class distribution of agricultural households indicates that the capitalist peasants as a class belong to all size groups of lands and family/or middle peasants came from those households which operate marginal, small and medium holdings. The poor peasants as a class belong to marginal farm size group.

Unlike Muzaffarnagar, Gorakhpur, district depicts a somewhat different picture in terms of class relations. All the classes of peasantry are observed in the district as Table 5.2 indicates. Although the capitalist peasants constitute about 31 per cent of the total households, yet the middle, small and poor peasants are preponderant in Gorakhpur. The peasantry, in general is not clearly differentiated in Gorakhpur as we found in case of Muzaffarnagar district. The preponderance of these peasants who hire out their labour in addition to self-employment of their family labour primarily refers to existence of semi-feudal production relations in the district. Table 5.2 indicates that a majority of the households belonging to the capitalist class are from the marginal and small holding sized groups of land. Family, small and poor peasants by and large belong to the marginal and small farm size groups.

Capitalist peasants irrespective of their percentage to total number of households command control over the supply of land, capital inputs and agricultural produce in Muzaffarnagar as evident from Table 5.3. They are also the main employers of agricultural labourers in

the district. The peasants of almost all classes cultivate more than one crop, as the cropping intensity indicates.

The relative position of different classes in terms of control over supply of lands, capital inputs and agricultural produce in Gorakhpur district is not much different from Muzaffarnagar as indicated in Table 5.4. The cropping intensity indicates that all the classes except capitalist landlords, cultivate more than one crop. One of the main reasons for the lower cropping intensity in Gorakhpur is that the district (and particularly two out of four villages taken into sample) is very prone to floods and every year substantial field crop is wiped away.

The above characteristics of class relations in agriculture clearly indicate the formation of a class of peasants bourgeoisie that demands for labour in agriculture and a class of agricultural wage labourers who supply labour for the capitalist peasants. This appears to be a case in respect of Muzaffarnagar in particular **not** in respect of Gorakhpur where the family, small and poor peasants are preponderant. It is small and poor

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peasants who depend upon agricultural wages but are also land owners and operators. Hence, they stand on the way to the process of capitalist transformation in agriculture because they do not farm a class of full fledged agricultural labourers or proletariates. The semi-politarian status of the small and poor peasants combines the elements of both, self-employment and wage labour.

--- In this way they partly retain the characteristics of earlier modes of production in which the owner of labour was not separated from the owner of the means of production. These characteristics are retained because of agrarian reforms which led to the retention of such peasants in rural areas.²³ In Gorakhpur district, there are some households belonging to scheduled castes who got land from the Government and became poor or small farmers.

Moreover, the development of capitalism is further restricted by the existence of caste system as a factor of feudalism particularly in district Gorakhpur where farmers belonging to upper and intermediate castes by and

²³Mishra, G.P., 'Agrarian Reform and Change in India, Mainstream, August 11, 1984.

large own and operate large holding size of land and lower castes (i.e. Scheduled Castes and Scheduled Tribes) are generally small and marginal land owners or landless agricultural labourer, as Table 5.6 shows.

Table 5.5 indicates that unlike Gorakhpur, Muzaffarnagar has undergone a somewhat clear-cut change where disintegration of caste bound agrarian social structure, owing to growing capitalistic development in terms of wage labour and money commodity relations, has given way to the emergence of capitalist relations of production in agriculture. The lower and intermediate castes constitute over 90 per cent of the total households falling in the category of capitalist and family peasants. Another noteworthy development which has taken place in Muzaffarnagar is that not only intermediate caste group constitutes (Koeri Bari, Pal, Verma and Gupta, etc.) a good over 20 per cent of the total landless agricultural labourers households, but even an upper caste landless household have also been found to be living on agricultural wages.

The above discussion clearly suggests that the technical form of production have changed and capitalist

relations of productions dominate the scene in the agriculture sector of Muzaffarnagar. While in Gorakhpur, it seems, that emerging capitalist relations are converging with the upper caste peasantry and as a result the class formation of peasantry is seconded to the castes in agriculture in Gorakhpur.²⁴

A case study of production relations in Muzaffarnagar and Gorakhpur which are representing Western and Eastern regions of the State indicates as to why the process of modernisation and growth has been more successful in Muzaffarnagar but less successful in Gorakhpur leading to spatial variations in the level of agricultural development and growth in the State.

²⁴Ibid, p. 195

**Table 5.1 : Class Distribution of Households by Holdings
Sized Group in Muzaffarnagar**

Classes	Land- less	Marginal holdings	Small holdings	Medium holdings	Large hold- ings	All groups
Capitalist Land- lords SE=0, HI>0, HO=0	NIL	NIL	NIL	NIL	NIL	NIL
Capitalist Peasa- nts SE>0, HI>0, HO=0	NIL	13.61 (30.67)	15.98 (36.00)	10.65 (24.00)	4.14 (9.33)	44.38 (100.00)
Family and Middle Peasants SE>0, HI=0, HO=0	NIL	9.47 (59.26)	5.33 (33.33)	1.18 (7.41)	NIL	15.98 (100.00)
Small Peasants SE>0, HI>0, HO>0	NIL	NIL	NIL	NIL	NIL	NIL
Poor Peasants SE>0, HI=0, HO>0	NIL	5.32 (100.00)	NIL	NIL	NIL	5.32 (100.00)
Landless Agricul- tural Labour SE=0, HI=0, HO>0	34.32 (100.00)	NIL	NIL	NIL	NIL	34.32 (100.00)
All Classes	34.32	28.49	21.31	11.83	4.14	100.00

Note : Figures within brackets refer to percentage distribution of Households of a given class by holding sized groups.

Table 5.2 : Class Distribution of Households by Holding Sized Group in Gorakhpur.

Classes	Land-less	Marginal holdings	Small holdings	Medium holdings	Large holdings	All groups
Capitalist Land-lords SE=0, HI>0, HO=0	NIL	3.74 (46.67)	1.60 (20.00)	1.07 (13.33)	1.60 (20.00)	8.02 (100.00)
Capitalist Peasants SE>0, HI>0, HO=0	NIL	14.44 (47.37)	9.63 (31.58)	5.35 (17.54)	1.07 (3.51)	30.48 (100.00)
Family and Middle Peasants SE>0, HI=0, HO=0	NIL	7.49 (77.78)	2.14 (22.22)	NIL	(NIL)	9.63 (100.00)
Small Peasants SE>0, HI>0, HO>0	NIL	11.76 (91.67)	1.07 (8.33)	NIL	NIL	12.83 (100.00)
Poor Peasants SE>0, HI=0, HO>0	NIL	26.74 (100.00)	NIL	NIL	NIL	26.74 (100.00)
Landless Agricultural Labour SE=0, HI=0, HO>0	9.09 (73.91)	3.21 (26.09)	NIL	NIL	NIL	12.30 (100.00)
All Classes	9.09	67.38	14.44	6.42	2.61	100.00

Note : Figures within brackets refer to percentage distribution of Households of a given class by holding sized groups.

Table 5.3 : Class Distribution of Technical Inputs and Productivity in Muzaffarnagar

Classes	% net cropped area	% of Gross Cropped area	Cropping Intensity	Value of Fertili- zer con- sumption per ha. of G.S.A.	Value of Agrl. Mech. per ha. of G.S.A.	Produ- ctivity per ha. of G.S.A.	% of Agri- cultural Prod.
1. Capitalist Landlords SE=0, HI > 0, HO=0	-	-	-	-	-	-	-
2. Capitalist Peasants SE > 0, HI > 0, HO=0	85.51	85.97	148.70	366.75	1349.32	1496.46	86.21
3. Family or Middle Peasants SE > 0, HI=0, HO=0	13.40	13.19	145.53	171.03	591.35	1437.82	12.71
4. Small Peasants SE > 0, HI > 0, HO > 0	-	-	-	-	-	-	-
5. Poor Peasants SE > 0, HI=0, HO > 0	1.09	0.84	115.02	82.81	92.89	1904.05	1.08
6. All Together	100.00	100.00	147.91	338.53	1238.74	1492.18	100.00

Table 5.4 : Class Distribution of Technical Inputs and Productivity in Gorakhpur.

Classes	% net cropped area	% of Gross Cropped area	Cropping Intensity	Value of Fertili- ser con- sumption per ha. of G.S.A.	Value of Agrl.Mach. per ha. of G.S.A.	Produc- tivity per ha.	% of Agricul- tural Prod.
1. Capitalist Landlords SE=0, HI>0, HO=0	29.05	18.74	78.96	85.14	424.20	392.70	16.04
2. Capitalist Peasants SE>0, HI>0, HO=0	49.59	55.97	138.08	116.45	614.43	537.41	65.52
3. Family or Middle Peasants SE>0, HI=0, HO=0	7.21	7.84	133.01	47.49	34.43	391.06	6.68
4. Small Peasants SE>0, HI>0, HO>0,	4.45	6.80	187.16	116.53	20.93	305.96	4.53
5. Poor Peasants SE>0, HI=0, HO>0	9.70	10.65	134.44	62.23	69.18	311.58	7.23
6. All Together	100.00	100.00	122.37	99.40	434.86	459.02	100.00

Table 5.5 : Composition of Castes in Classes

Muzaffarnagar

Castes	Capitalist Landlords	Capitalist Peasants	Family or Middle Peasants	Small Peasants	Poor Peasants	Landless Agrl. Labour	Total
Upper Caste	NIL	5.06	3.70	NIL	NIL	1.72	3.14
Intermediate Caste	NIL	64.56	55.56	NIL	25.93	20.69	44.50
Lower Caste	NIL	30.38	40.74	NIL	74.07	77.59	52.36
Total	NIL	100.00	100.00	NIL	100.00	100.00	100.00

Table 5.6 : Composition of Castes in Classes

Gorakhpur

Castes	Capitalist Landlords	Capitalist Peasants	Family or Middle Peasants	Small Peasants	Poor Peasants	Landless Agrl. Labour	Total
Upper Caste	66.67	22.81	5.56	NIL	4.00	NIL	13.90
Intermediate Caste	33.33	70.17	83.33	25.00	44.00	34.78	51.34
Lower Caste	NIL	7.02	11.11	75.00	52.00	65.22	34.76
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00

CHAPTER VI

An Overall View

In this chapter, the main findings of the present study are summarised with concluding notes at the end. An attempt is also made to suggest the policy implications flowing from the findings and conclusions.

The major focus of the present study is (i) to examine the process of modernisation and growth in agriculture in context of U.P.; (ii) to find out factors responsible for inter-regional and intra-regional variations in agricultural growth as a consequence of their corresponding variations in the process and form of modernisation; and (iii) to examine how the process of modernisation involves diversification of agriculture and its allied activities. Another related issue of the study is to demonstrate that a given level of technology in different regions or different areas of a given region, the productivity may not be essentially in the same order. For, the process of modernisation must accompany the transformation of agrarian production relations into a new one wherein peasants are more responsive and adaptive to changes in the technical form of production in agriculture.

In the pre-independence period, the agrarian sector presented a picture of deterioration or stagnation. The existence of low level of technology in India's agriculture was one of the major factors for its underdevelopment. The major inputs other than family labour, were a pair of bullocks and a wooden plough. Agriculture was greatly dependant on the vagaries of nature. Heavy rain fall caused floods and soil erosion; while scanty rains reduced production to an extreme even in the irrigated areas. Availability of water for cultivation frequently fluctuated with irregular rain-fall. The farmers relied on the seeds from the previous harvest used certain amount of farm yard manure, and gave little attention to important tasks like weeding.

In fact, the basic cause of the steady and continued deterioration in the agrarian situation was apathetic and exploitative policies pursued by colonial rule towards the problems of development in general and agriculture sector in particular. These policies were, essentially, one of the buttressing the feudal

agrarian relations in the rural sector with a view to having a social base in the country-side among the class of land-owners and retarding development so that the country could be retained by them as a colonial appendage of the British economy.

Modernisation of U.P. Agriculture

The post-independence period was marked by a sharp contrast from colonial approach and policy towards agriculture. The government now considered land reforms and change in the agrarian relations, the initial step for ushering in a period of development. It also considered promotion and direct participation in the development of the economy in general and agrarian sector in particular as its major responsibility. A series of measures such as the abolition of the intermediaries and ensuring of security of land tenure for the cultivator, and introduction of Panchayat Raj System etc. were taken to recast the institutional framework in the agrarian sector. These were followed and accompanied by a programme of development under the successive plans commencing with the First Five Year Plan launched in 1950-51.

A steep fall in crop production in the drought year 1957 raised a concern about the future. Government of India invited a team of agricultural experts, sponsored by Ford Foundation, to work in close co-operation with Indian experts in making careful study of agricultural situation and to make recommendations for future action. The government accepted in general the recommendations made in the report entitled "India's Food Crisis and Steps to Meet it" and invited a Second Ford Foundation Team to assist in planning the Intensive Agricultural District Programme. The team submitted its recommendations in a report entitled "Suggestions for Ten Point Programme to Increase Food Production" published in 1959. The most significant recommendation of the team was to channelise the efforts on popularising modern inputs and practices in the most productive areas where these were more likely to show results. Subsequently, nearly all but a few were approved by the government and the Intensive Agricultural District Programme moved from idea to implementation and action stage in 1960. The establishment of the IADP was thus a new dimension in the direction of modernising Indian agriculture.

The food situation on the eve of the Green-Revolution was, to say the least, alarming. In 1965 a 'new strategy' for agriculture for the fourth Five Year Plan was formulated. The major feature of the new strategy is its 'package' approach which included HYV seeds, fertilisers, pesticides, controlled water supply and mechanical equipments from seeds drills to tractors and threshers. The new strategy was thus a package of modern inputs and practices, popularly known as HYV technology. Another major feature of this new strategy is the emphasis it places on the organisational and institutional arrangement for the production, import and distribution of the entire package inputs. The technology associated with high yielding varieties, which is popularly known as 'Green Revolution', is not merely a package of inputs but also incorporates a host of new agricultural practices. The new technology follows a new crop calender, given the shorter maturing period of HYV seeds, the possibilities of multiple cropping and the associated changes in cropping pattern and crop rotation.

Cropping Pattern

Since mid-sixties, the production conditions and the cropping patterns have undergone a great change due to the introduction of new agricultural technology. In better irrigated regions such as Western region, the cropping patterns have changed more pronouncedly than elsewhere in the State. The lucrativeness of a crop is the function of both of its yield and relative price level. In a situation where the yield levels for different crops have experienced varying degrees of upward shift, even slightly lower relative prices have made the high yielding crops much more lucrative. The wheat and rice have emerged as the most important crops of the State covering over 53 per cent of gross cropped area in 1980-81 while these accounted only a little over 34 per cent in 1951-52. On the other hand crops such as gram, barley, jowar, bajra and pulses have become less important crops in terms of area under cultivation. Cropping pattern in the Western and Eastern regions is more or less the same as observed at the State level. There is a marked difference between two regions with respect to area under maize and sugarcane. Area under these crops as percentage

to gross cropped area increased considerably in Western region while Eastern region could not match the performance. A marked difference in cropping pattern between Muzaffarnagar and Gorakhpur districts is in terms of area under sugarcane which is about 31 per cent to gross cropped area in Muzaffarnagar, while it covers only ^{about} 3 per cent in Gorakhpur in 1981. Since mid-sixties there has been a considerable decline in area under gram, barley and pulses in rabi crop and jowar and bajra in kharif crop at State, region and district level. Virtually since 1965-66, the farmers have shown a tendency of concentrating on growing specific crops rather than adopting multiple cropping system. This is clearly a progressive attitude towards the new technological development during sixties and also the commercialisation trend of farming business.

Intensity of Cropping

The cropping intensity which is an indicator of intensiveness of land use increased to 142.69 per cent from 123 per cent in the State of Uttar Pradesh during

1951-52 to 1980-81. The Western and Eastern regions alongwith the districts of Muzaffarnagar and Gorakhpur reveal the same trend of increase in cropping intensity during the 1951-52 to 1980-81. Though in terms of percentage Eastern region started with higher cropping intensity (129.58 per cent) as compared to Western region (122.05 per cent) it could not maintain the lead and lagged behind. Muzaffarnagar and Gorakhpur districts started nearly on equal terms (129.63 per cent and 128.32 per cent respectively) but Gorakhpur could not match the performance after mid-sixties. The present trend indicates that both regions (Western and Eastern) along with their respective districts of Muzaffarnagar and Gorakhpur had have an edge over the State in terms of cropping intensity.

Irrigation

Development of irrigation which is one of the most important and essential inputs for the success of HYV seeds and increasing agricultural production, is still not very satisfactory in the State. Though there has been significant increase in the extent of

irrigation, it is far behind the desired level. The extent of irrigation in Western region and in the district of Muzaffarnagar have been much higher than what is found in Eastern region and Gorakhpur district. The most of the increase in irrigated area has been associated with the post-Green Revolution period (1965-66 onwards) wherein government introduced various policies to encourage the minor irrigation development works.

✓ The most important source of irrigation, at the beginning of planning, was wells followed by canal in terms of irrigated area in the State of U.P. This trend continued till mid-sixties and importance shifted thereafter from the traditional sources of irrigation to modern sources like tube-well and pump-sets. Although Western region alongwith district Muzaffarnagar shows the same type of change in source-wise irrigation as in the State, the Eastern region and Gorakhpur district differ in the sense that area irrigated by both canal and tube-well has increased. It is so because Western region and Muzaffarnagar district started with already higher resource base in terms of canal irrigation.✓

HYV Seeds

Introduction of HYV seeds in 1966-67 revolutionised the Indian agriculture. The coverage under HYV seeds in Eastern region and Gorakhpur district has been higher than in the State, while the Western region and Muzaffargarh maintained, more or less, the State average. Although there has been a tremendous increase in area under HYV wheat and paddy at all levels (i.e. State, region and district) but the area under HYV maize, jowar and bajra either grew marginally or declined over the period 1967-81.

Fertiliser

Traditionally the level of consumption of fertiliser, which is one of the major inputs for increasing the production especially of new varieties of seeds, has been very low in the State of Uttar Pradesh. The consumption of fertiliser grew rapidly with the introduction of High Yielding Varieties of seeds in agriculture since 1966-67. The total consumption of fertilisers increased over the period 1957-81. But

the increase in the use of nitrogenous fertiliser is worth-noting in the sense that the increase in its consumption is more than the increase in the use of other chemical fertilisers. The trend of increase in fertiliser consumption is the same at all levels but the extent varies. Level of fertiliser consumption in both of the regions and districts is higher than State average. The level of fertiliser application in Western region and Muzaffarnagar is much higher than what is observed in Eastern region and Gorakhpur respectively.

Agricultural Machinery and Implements

The use of agricultural machinery and implements like tractors, pumpsets and threshers has increased significantly since mid-sixties. It is, however, still far behind the desired level. Western region and Muzaffarnagar district are ahead not only of Eastern region and Gorakhpur district but also State in this respect.

In brief the foregoing analysis clearly indicates that agriculture in Western region and Muzaffarnagar

is more modernised and developed than in Eastern region and Gorakhpur district in terms of cropping pattern, fertiliser consumption area under HYV of seeds and agricultural machinery and implements per hectare.

Growth in Agriculture

The trends in growth with respect to area production and yield per hectare are found to be significant in case of paddy, wheat and oilseeds in the State of U.P. during 1951-52 to 1980-81. Total foodgrains and sugarcane experienced a moderate increase in area; production and yield over the same period. Among individual crops, wheat followed by maize recorded the highest rate of growth in area while paddy followed by wheat excelled with respect to production and yield over the reference period. The rapid growth in area (4.83 per cent), production (8.05 per cent) and yield (3.07 per cent) under wheat cultivation has been associated mainly with the post-Green Revolution period as compared with pre-Green Revolution period growth rates of 1.97 per cent, 3.37 per cent and 1.38 per cent per annum for area, production and yield

respectively. Though oilseeds recorded a significant growth in area (2.31 per cent) and production (2.59 per cent), it could muster only a nominal growth rate (0.27 per cent per annum) in yield over the period under study. Sugarcane performed poorly with respect to growth in area (0.39 per cent) but recorded significant growth in production (1.85 per cent) and yield (1.46 per cent). The growth in area under barley, jowar, bajra and pulses cultivation shows a declining trend over the entire period.

The pattern of growth with respect to area, production and yield per hectare under different crops, in both Eastern and Western regions show more or less the same course though the rate of change differs over the period 1951-52/ ^{to 1980-81.} Among the individual crops, superior cereals like wheat and paddy recorded highest rate of growth with respect to area, production and yield per hectare in both the regions. The Western region did equally well in case of maize as well during ^{to 1980-81.} 1951-52/. Growth in area, production and yield under wheat cultivation is higher in the Eastern region while the Western region excelled in case of paddy and maize cultivation. A noteworthy point is that

growth in area production and yield under wheat and paddy has been faster during post-Green Revolution period in the Eastern region while growth rate in case of paddy and maize has been lower and higher in case of wheat during post-Green Revolution period in Western region. Growth rate under pulses cultivation is not well convincing in both of the regions. Among non-food crops, sugarcane reported a spectacular growth in production and yield but performed miserably in terms of area in both the regions over the entire period.

Although the trend of growth in area, production and yield under major crops is more or less similar in Gorakhpur and Muzaffarnagar, there are, however, considerable variations in the rates of change. The pattern of growth in area, production and yield is significant in case of paddy, wheat and sugarcane in both districts. Gorakhpur presents an appreciable growth in production and yield along with a positive growth in area with respect to gram also. Needless to stress that most of the increases were made possible during post-Green Revolution period. Gram is the only crop where there is a marked difference in the pattern

of growth in area, production and yield in two districts. Gorakhpur achieved significant growth in production (4.69 per cent) and yield (4.13 per cent) along with a marginal growth in area (0.53 per cent) while Muzaffarnagar could not follow the suit and reported a negative growth in area, production and yield under gram cultivation over the period 1951-52/^{to 1980-81.} Although all foodgrains attained a similar positive growth in both the districts; growth in area, production and yield is more convincing in Gorakhpur district than what we observe in Muzaffarnagar district. This is due to the fact that the growth in Gorakhpur started with low base while that in Muzaffarnagar has the history of high base.

On the whole, it is observed that growth in area was higher in the pre-Green Revolution period whether we analyse the data for the State, regions or the two districts; the only exception being wheat which recorded a relatively higher growth in area during the post-Green Revolution period. In the case of production and yield growth, however a reverse trend is observed. It is by and large during

the post-Green Revolution period that a relatively higher growth in both production and yield is observed as compared to the pre-Green Revolution period. There are, of course, some exceptions with respect to one crop or the other wherein this observation does not hold good either at the State, region or district level.

Modernisation and Growth

The regression analysis undertaken in Chapter IV shows the existence of positive relationship between yield levels for crops and various indicators of modernisation in U.P. during 1956-57 to 1965-66 where they offered 83.6, 80.7, 66.8, 63.7 and 60.9 per cent explanation in terms of R^2 value for the crops like foodgrains, wheat, oil-seeds, sugarcane and paddy respectively. A noteworthy point is that the explanatory power of the same set of variables declines sharply for all crops during the second phase 1966-67 to 1980-81 when area under HYV is excluded. But with the inclusion of HYV in the given set of variables, the R^2 value significantly improved especially in case

of paddy and foodgrains in the State since 1966-67 to 1980-81. However, the inclusion of HYV did not make much difference to the level of explanation in case of wheat oilseeds and sugarcane in particular. The improvement in explanatory power as a result of inclusion of HYV in the set of variables clearly demonstrates that HYV technology has some kind of built-in stability in crop yields, otherwise there could have been the situation as the R^2 values obtained in the second phase without HYV. The region-wise regression results indicate that in case of Eastern and Western regions, the choosen indicators provide sufficiently higher level of explanation for yield levels but this association is more convincing and clearly revealed during post-Green Revolution period than pre-Green Revolution period. The level of explanation is higher in Western region than in Eastern region. The inclusion of HYV significantly improved the level of explanation in both regions for almost all crops which speaks of the importance of HYV seeds for raising the crop yields like wheat and paddy. The level of explanation is lower in Muzaffarnagar than in Gorakhpur for all crops except

in case of sugarcane during the first phase. But during the second phase, the model explains 87, 73 and 80 per cent contribution of modernisation towards yield in paddy, wheat and foodgrains in Muzaffarnagar. The inclusion of the area under HYV seeds further improves the level of explanation for all crops taken into consideration in both districts. But this improvement in level of explanation is of higher magnitude in Muzaffarnagar than in Gorakhpur, which suggests that the impact of high yielding varieties on agricultural productivity is higher in Western region and Muzaffarnagar district than in Eastern region in Gorakhpur district. It indicates that in parts or areas where assured water supply and better water use is a reality, responsiveness of HYV technology would be higher. On the whole regression results show that the indicators of modernisation considered in the study have significant explanatory power. However, the effectiveness of these variables in yield growth varies from one region to another and one district to another at the inter-regional level.

t-values depicting individual significance of various measures of modernisation to yield levels in

different crops also suggests the positive relationship between modernisation and growth in U.P. agriculture. The regression analysis of factors determining the yield level of different crops in agriculture makes it clear that there is a definite positive association between various indicators of modernisation and yield level at least in paddy, wheat, total foodgrains and sugarcane at State, region and district level. Besides our study indicates a positive impact of various indicators of modernisation on yield of oil seeds at all levels. But the explanation for maize is found to be satisfactory in Western region only. The relationship between modernisation and growth is observed to be more pronounced and visible during 1966-67 to 1980-81. Likewise the explanation is higher in Muzaffarnagar district and Western region than in Gorakhpur district and Eastern region.

F-statistics also suggest that model is fit to explain the relationship between dependent and independent variables particularly during 1966-67 to 1980-81. F-value is significant at 5 per cent level in case of total foodgrains and that too in district

Gorakhpur only during the first phase 1956-57 to 1965-66 while it is found to be significant in case of almost all the crops taken into consideration at all levels (State, region and district) level during 1966-67 to 1980-81.

Growth and Occupational Diversification in Agriculture

It is commonly held that occupational diversification is natural outcome of economic development. Economic development triggers off the forces that work on transforming the economy in such a way so as to reduce the dependence of working population on agriculture and more and more labour is demanded in non-agriculture sector. Theoretically, the process of occupational distribution involves an increase in farm sector income (as a result of agricultural growth), which, in turn, raises the demand for non-agricultural commodities and services and thereby necessitates an increase in demand for labour to meet out the increasing demand for non-agricultural goods and services.

The share of agriculture in State income has persistently declined and that of manufacturing and

services has registered an increase in the last thirty years in U.P. But occupational pattern does not show any substantial change, except some marginal increase in the proportion of non-agricultural workers in total workers. In this regard, occupational diversification seems to have negligibly taken place in the State. In fact, the proportion of non-agricultural workers to total workers has increased by 5 per cent in the State during the last thirty years; while the share of non-agricultural income has gone up from 41 per cent in 1951 to 58 per cent in 1981. This presents a paradoxical situation in the State. When the case of occupational diversification measured in terms of proportion of non-agricultural workers to total workers is examined in relation to three variables such as agricultural income per worker, area under commercial crops and proportion of non-agricultural income to total income in the State; the regression analysis presents some interesting results. The regression, results present a high level of association between occupational diversification and these three variables. In other words, the occupational diversification is positively related to modernisation and growth in agriculture and its allied activities. But the marginal change in the

occupational structure of work force presents a disappointing picture and raises the question of why occupational diversification is not correspondingly accompanied by modernisation and growth in agriculture.

No doubt, the State performed well on the front of agricultural production but failed miserably in mobilising the surplus created in agriculture to broaden and diversify the infrastructure so as to offer more employment opportunities in non-agricultural sector and release the surplus labour from agricultural sector. Moreover, the process of development in India in general and in Uttar Pradesh in particular has been accompanied by the persistence of demand and supply constraints on its development. The demand constraints denote the lack of effective demand while the supply constraints owe the existence to sluggishness in the rate of capital growth.

It is commonly held that growing income inequalities in agriculture put a limit on the creation of demand for industrial goods and consequently, on the utilisation of industrial capacity. There also exist supply constraints because the generation of

agricultural surplus i.e. marketable, is not only sufficient condition for development but also the existence of some mechanism and motive to capitalise it. The process of inter-change of surplus between agriculture and non-agriculture sector depends on the form of development of home market which is conditioned by the social division of labour and social relations between labour and capital as a means of production. ---In agriculture many of the peasants are not separated from the means of production and also hire out labour for subsistence consumption. In this case, the surplus goes to money-lenders or traders which is called the forced commercialisation. Thus under the conditions ^{of} forced commercialisation, the marketed surplus is not transformed into capital as such but into interest bearing or merchant capital. Thus, obviously forced commercialisation is linked with interlocking of product, credit and land markets.

Production Relations in U.P. Agriculture

Modernisation of agriculture aims at changing the tradition bound technical form of production into

modern technical form and also making the peasants responsive and adoptive to new changes in the technical form of production in agriculture. Various programmes to modernise U.P. agriculture, since inception of planning have paid dividends and traditional production relations have given way to the emergence of a new type of production relation, i.e., capitalist relations of production. But the emergence of such production relations is not spatially uniform. As a result, modernisation and growth in agriculture are also not uniform spatially in U.P. The present study shows that the Western region of the State has experienced emergence of capitalist production relations more pronouncedly than what the Eastern part has over a period of time. A similar comparative situation is observed in the case of Muzaffarnagar and Gorakhpur belonging to the Western and Eastern regions respectively. As a result, modernisation and growth are found to be more pronounced in the Western part than in the Eastern part of the State. Thus the analysis of production relations indicates as to why modernisation and growth

are spatially not uniform in U.P.'s agriculture.

In brief the present study indicate that modernisation leads to agricultural growth. There are spatial variations in the spread, magnitude and impact of modernisation in U.P. Western region has undergone the process where not only the technical form of production has changed into a new one but also a class of progressive peasants have also emerged. A comparative picture shows that modernisation of agriculture in Eastern U. P. has not been that much successful/as in Western region and changes in technical form of production have been partial. That is why Western region is the most developed region of the State. Thus agricultural development varies from one region to another and from one area to another within a given region as a consequence of their corresponding variations in the process and form of modernisation. Modernisation of agriculture has stepped up growth in the agriculture sector of the State economy. But it is not spatially uniform in agriculture, as the case study of Western and Eastern regions of the State shows. ✓

Growth in agriculture has not resulted in occupational diversification. During 1951-52/^{to 1980-81} there has been only a marginal decline in the share of male agricultural workers in total male workers in U.P. Why occupational diversification is not taking place? The obvious explanation may be that surplus derived from agriculture is being siphoned out and is not converted into the capital on account of demand and supply constraints. Growing income inequalities in agriculture delimit the creation of demand for industrial goods and consequently the utilisation of industrial capacity. Moreover, inter-locking of markets for product, credit and land facilitates the 'forced commercialisation' which in turn results in capital being siphoned out in the form of traders or merchant capital. Under the conditions of 'normal commercialisation' the generation of supply would be for 'gains from trade' and capital formation will take place. But normal commercialisation will take place only if markets for product credit and land are differentially specialised and separate which is possible only by separating completely the labour as a commodity and means of production. Added to all this, capitalist production relations have not emerged

spatially uniform in agriculture. In the Western part of the State, such production relations secured to have emerged but not in the Western part. A clear-cut emergence of capitalist relations is an essential condition for high level of modernisation, for high rate of agricultural growth and occupational diversification in the State. But such a picture is not clear but a mixed one.

Hence not only modernisation of agriculture is required but also structural transformation of agriculture for creating suitable production condition in agriculture.

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